



MARK ROBERTS MOTION CONTROL

# **Safety Procedures for Using Industrial Robots**

(Including those on high speed track)

Note, the words Robot and Rig are completely interchangeable and identical in meaning, for the purposes of this document.

## Introduction

- Due to the high speeds and accelerations that industrial robots can achieve the following procedure should be observed at all times.
- This guide is in addition to the normal Safety Manual instructions that are applicable to all motion control rigs, such as Milos.
- It is ultimately the operator of the rig who is responsible for the safe use of the equipment so never bypass any of the points listed below.
- No-one other than a highly trained operator should use the robot, no matter how simple it looks or is.
- This document is for the use of robots for carrying cameras or props, not people. Additional safety steps should be taken prior to using a rig to carry people.
- ★ If the robot includes track then extra steps should be taken during installation and use due to the additional risks involved. Steps specifically included for track users are marked with a ★.
- The reason for these instructions is because unlike traditional motion control equipment, these robots can get to maximum speed in the blink of an eye – too fast for someone to be able to quickly move out of the way.

## Installation

- Due to the large mass of the rigs and the accelerations they achieve it is important that they are securely mounted, with the recommended plates and bolts to a secure and concrete floor.
- ★ When using rail ensure the rail is properly bolted to the floor. No amount of counterweight will stop the rails from moving and twisting if the rail isn't bolted, especially with short lengths of rail.
- ★ There should be plenty of clearance around the length of the rail for the trailing cables of the rig to slide along the floor. Ensure that they are not mounted in such a way so that they can catch on the rail or robot as it moves along the full length.
- Ensure the floor can support the load and the stresses.
- If the rig is mounted to something other than the floor then it should be heavy and strong enough to take the forces and not move or fall over during sudden starts and stops. Use the recommended minimum thickness steel plates. Check with MRMC if you are unsure of the exact requirements for your robot.
- Check all cables are securely fixed and are not going to catch during motion.
- Ensure the power source has sufficient capacity for the robot and is the right mains voltage.
- Ensure the camera, lens, focus motor, accessories, power supplies/batteries, etc. are all very securely mounted and will not come off during sudden motions, to become lethal missiles.
- Ensure all safety accessories are securely attached and in working order, including emergency stops, safety sensors etc.
- Clearly mark the area around the robot in which no persons are allowed to enter. Minimally use brightly marked tape on the floor, outside the reach of the robot, to indicate the "No Go Zone". Ideally, use physical safety barriers, and light guards/curtains.
- Where physical safety barriers are impractical, light guards should be used or similar alternatives such as laser scanners, to stop anyone entering the No Go Zone during motion.
- Ideally have the robot surrounded on all 4 sides by a safety barrier, but where that is not practical, ensure that the maximum number of sides feasible are closed off, and that any person having to stand within reach of the robot is located as far away as possible for the shot.
- ★ Never let anyone cross the robot's rail when the track motor is powered up.

## Software Setup

- Always ensure you have the right configuration for the robot you are using, such as maximum speeds and accelerations.
- Prior to running moves, enter in and keep to a minimum all software axis and Cartesian limits. For example if the main axis only needs to travel  $\pm 40$  degrees then reduce the limit to  $\pm 40$  degrees even though it could do  $\pm 180$  degrees. This keeps the likelihood of operator or software errors to a minimum.
- Also check the Cartesian speed and acceleration limits are set to reasonable values.

## Use

- Always tell the production company and the crew to keep away from the robot and not approach it when its red light is on which indicates it is powered. Have them sign the disclaimer to ensure they understand this and are indemnifying MRMC if anything happens.
- Keep stands, lights & accessories out of the No Go Zone, if possible. If not possible then try to take as much care with their positioning and the motion of the rig, as if they were a person. Remember a light, accidentally hit at high speed by the robot, can be just as dangerous to someone standing outside the No Go Zone as the robot is to someone standing in the zone.
- Always run moves only when standing within easy reach of the emergency stop.
- Always loudly and clearly indicate to others when the rig is about to move. Shout "Rig Moving!" if no other means exists.
- ★ When using track motion always have someone keep an eye on the trailing rig cables to ensure they don't get caught on anything or anyone.
- Always ensure the rig is disabled when someone has to enter the No Go Zone.
- Always run any move or adjusted move, slowly to check the motion first. Even if you have checked the move previously, if you make a minor change to it, it should be rechecked.
- Keep the software in "slow mode" unless the move has been tested and is now specifically doing a high speed pass.
- In the event that a person or Actor has to be within the no-go zone during a move (hand model etc) ensure that they fully briefed on the safety requirements and that they know not to change their position or do anything other than the rehearsed moves without fully warning the operator. Any such person is to have a clear escape route to allow them to move safely away from the robot.
- During use, repeatedly check the rig mounting points, cables, camera mount, accessories etc. to ensure nothing has, or is, working its way loose.
- Never bypass any safety hardware or software.

I, \_\_\_\_\_ have read this and understand it. Signed \_\_\_\_\_