



MARK ROBERTS MOTION CONTROL

# TX90L MODEL MOVER

COMPACT LIGHTWEIGHT HIGH SPEED MODEL MOVER



## QUICK START GUIDE

QSG Product Code: MRMC-2092-00

Products Covered: 20359

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<b>Contact information</b>	
<b>Mark Roberts Motion Control Ltd.</b>	
Unit 3, South East Studios	
Blindley Heath	
Surrey	
RH7 6JP	
United Kingdom	
Telephone:	+44 (0) 1342 838000
E-mail:	info@mrmoco.com (sales and general enquiries) support@mrmoco.com (customer support)
Web:	www.mrmoco.com www.mrmocorentals.com

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## Chapter 1 Quick Start

### Overview

Thank you for using the TX90L Model Mover from Mark Roberts Motion Control (MRMC). TX90L Model Mover is designed for reliable day-in, day-out use in professional studio and Outside Broadcast environments. It has a small, lightweight robotic arm which can be used either as camera rig or model mover.



**TX90L Model Mover** can be attached to the floor or a suitable platform.

## Safety procedures for using industrial robots

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

Motion Control rigs are potentially dangerous. It is important that you and everyone else on the set understand the safety notes on the following pages in order to stay safe.

You should use this document in addition to the normal Safety Manual instructions that are applicable to all motion control rigs, such as Milos. This section emphasises the safety concerns that are especially important around high-speed, high-acceleration, industrial-grade robots which can cause severe injuries, such as TX90L Model Mover.

- Unlike traditional motion control equipment, TX90L Model Mover 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.
- It is ultimately the **operator** of the rig who is responsible for the safe use of the equipment so never bypass any of the safety points listed here.
- 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.

## Assessing a site

Before setting up TX90L Model Mover you need to **assess the site**, paying particular attention to the following points:

- Does the site have access? You need to make sure you can carry it there using a pallet truck or forklift.
- Does the site have a power source with sufficient capacity for the robot and the correct mains voltage?
  - TX90L Model Mover requires a **240 Volts, single-phase power supply via a 16amps power connector**.
  - The computer stack that controls TX90L Model Mover (that is, the desktop computer and the power supply brick for the RT-14 interface box) are auto-switching and can run on 120-240 Volts AC.
- Does the site have unusual environmental attributes that require specialised protection from extreme temperatures, humidity, rain, or dust?

## Installation safety

- 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. Ensure the floor can support the load and the stresses (see above).
- Ensure the power supply is properly earthed (grounded) and of the correct voltage (see above).
- If the rig is mounted to something other than the floor then the mount 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 that all cables are securely fixed and are not going to catch during motion.
- 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. As a bare minimum, 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.
- Keep stands, lights and 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.
- 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 four 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.



## Software setup

- Always ensure you have the right configuration for the robot you are using, such as maximum axis 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 +/-40 degrees then reduce the limit to +/-40 degrees even though it could do +/-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.

## Operational safety

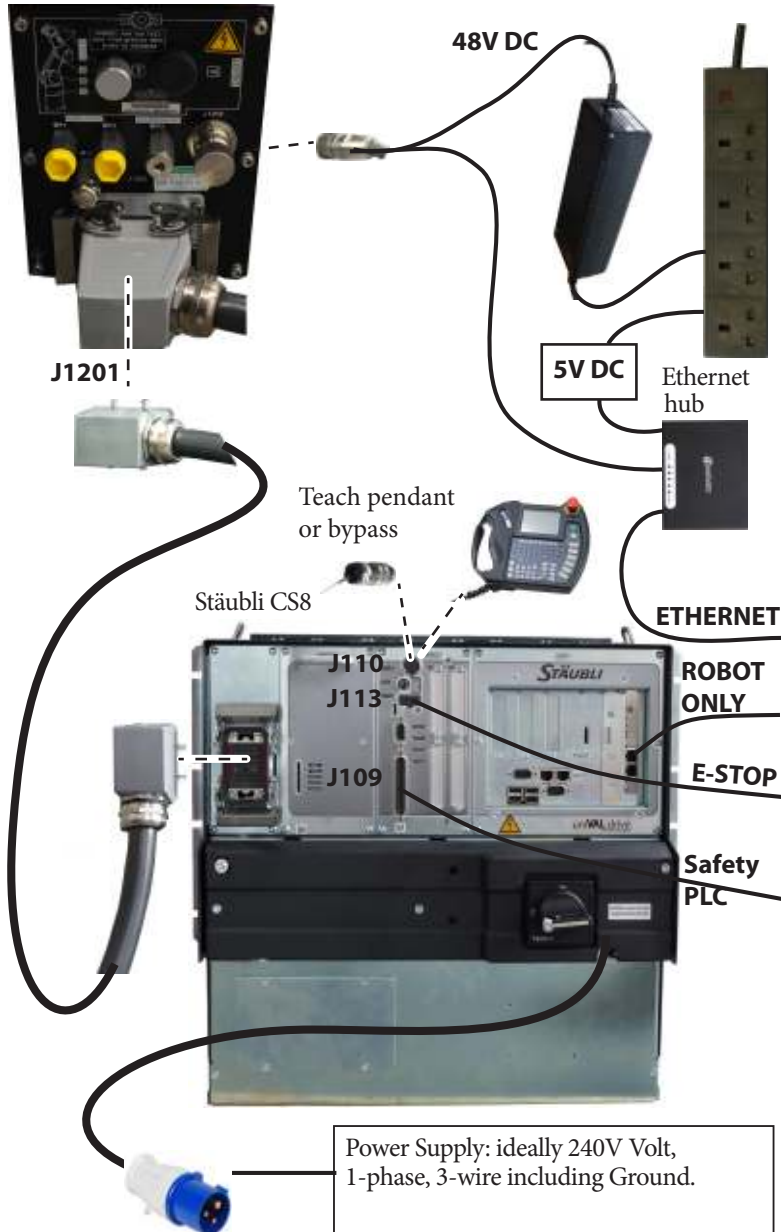
- Do not use around flammable gas. All electrical equipment can generate sparks that can ignite flammable gas.
- Keep the equipment dry. The system has **not** been made weatherproof. Do not use with wet hands.
- Always run moves only when standing within easy reach of the emergency stop.
- Always tell the production company and the crew to keep away from the robot and not approach it when any of its red lights are on which indicates it is powered up. Have them sign the appropriate safety documents and disclaimers to ensure they understand this and are indemnifying MRMC if anything happens.
- Always loudly and clearly indicate to others when the rig is about to move. Shout “Rig Moving!” if no other means exists.
- Always ensure the rig is disabled when someone has to enter the No Go Zone.
- Always run any move or adjusted move slowly at first to check the motion. Even if you have checked the move previously, if you make a minor change to it then you need to recheck it.
- 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 are

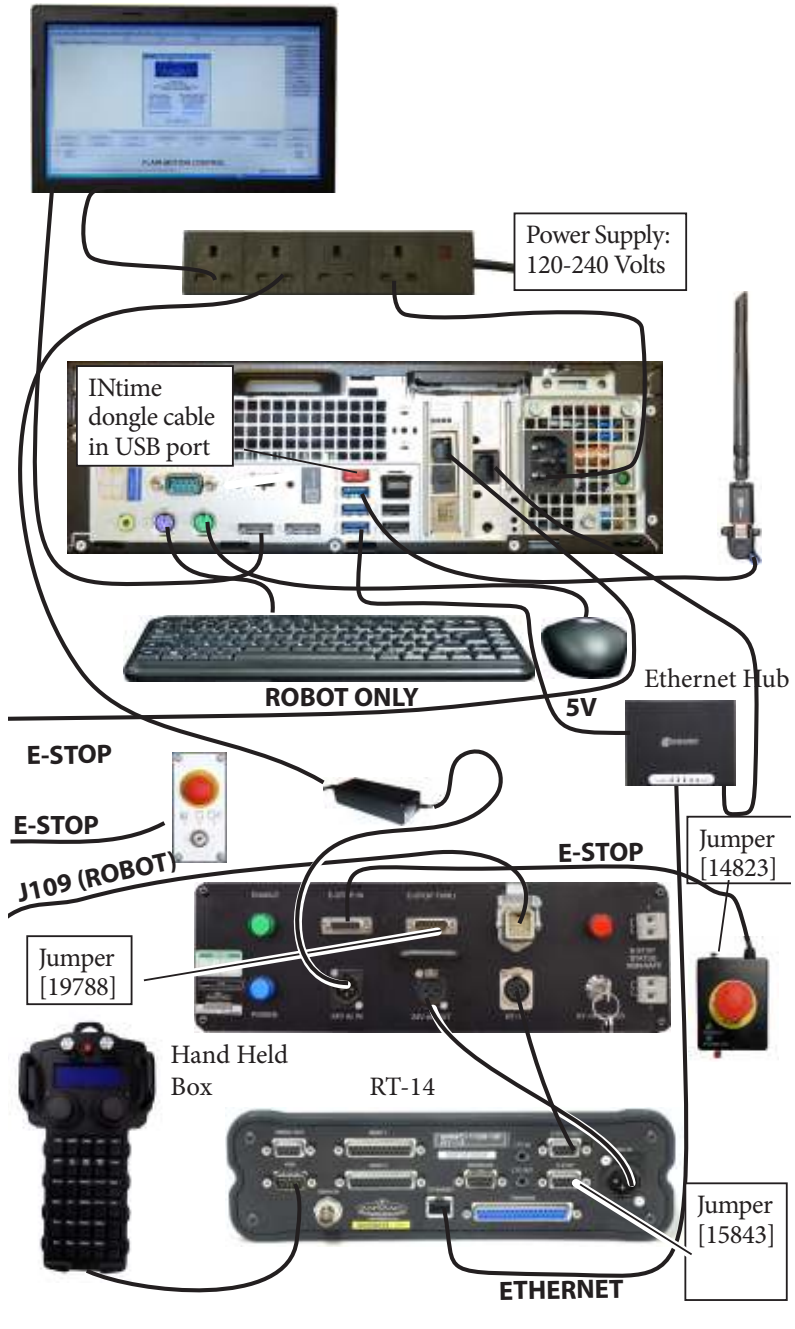
fully briefed on the safety requirements and that they know not to change their position or do anything other than the rehearsed moves without fully warning the operator. Any such person is to have a clear escape route to allow them to move safely away from the robot.

- 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.

Notes

## Connecting the cables





## Starting up the TX90L Model Mover system

Once you have attached all the cables, you power up the rig by switching on the components in the order described below.

1. Make sure you have secured the area around TX90L Model Mover. Put up guard rails around TX90L Model Mover as necessary, and tell others on the set that you are now powering up the rig.
2. Power up TX90L Model Mover as follows:



Turn on the power switch  
on the Stäubli CS8.



The TX90L Model Mover power-up sequence takes about three minutes.

Hint

When the power-up sequence has completed, the Stäubli CS8 shows an “A” on its display.



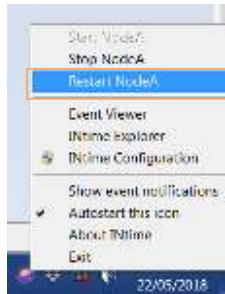
3. Power up the Flair computer system and all of its components, including the RT-14 interface box. You can do this while the robot is powering up (step 2). **Do not start the Flair application yet.**
4. After the robot has finished powering up (step 2), the cifX board in the Flair PC display two steady lights and one blinking light (see diagram above).

If the cifX board lights do not show as above after about three minutes, then close Flair and restart INtime as follows:

- 4.1 In the Windows Taskbar, right-click the INtime icon.



4.2 Select **Restart NodeA**.



4.3 Wait for steady connection to be established (2 steady green lights).

5. On the Flair PC, start the Flair application by double-clicking on the Flair icon on the Desktop.

6. Release the E-stop that is plugged into the computer stack, by turning the button clockwise until the red button pops up and then pressing the Enable button. Also make sure the key on the Safety PLC is in the vertical position. The horizontal position of the key bypasses E-stop from Hand Held box and Flair. Therefore, the key should **not** be kept in horizontal position when using TX90L Model Mover except for testing purposes.



Enable button

Key in vertical position



Once all E-stop buttons on the system are up, the Stäubli CS8 display shows “U”.

7. In Flair, click on the **Engage Robot** button.



- In Flair, move the TX90L Model Mover arm to its home position (rotated straight forward and tucked under).

Hint

If the TX90L Model Mover arm is in a backward or reversed starting position, the arm might swing overhead or around the side to reach the home position, possibly striking the walls, ceiling, or other rigging! If the rig is in an enclosed space or near other equipment, it is recommended that you do the following:



- Manually move the arm close to its home position before Homing it.
- When you home the rig, have one hand ready on the E-stop in case you need to stop the rig quickly.

- Set the soft limits for the rig axes in Flair as required.

### TX90L Model Mover start-up summary

- Secure the area
  - Release the E-stop on the rig
  - Switch on TX90L Model Mover
  - Switch on the Flair PC
  - Check networking lights after three minutes; **Restart NodeA** if needed
  - Start Flair
  - Release the E-stop on the computer stack
- In Flair:
- Engage Robot**
  - Home the arm, carefully
  - Set the soft limits

The rig is now ready to use.

## Shutting down the TX90L Model Mover system

1. Move TX90L Model Mover to its Home position.

or...

If you are going to transport TX90L Model Mover to a new location, put the TX90L Model Mover arm into its transport position. You can do this either by using Flair (although you might have to reset the soft limits to reach the transport position) or by moving the arm manually. For details see page 15.

2. In the Flair software, click on the **Disengage Robot** button.
3. Press down the E-stop button.
4. Close the Flair software.
5. Shut down Windows on the Flair PC.
6. Turn off TX90L Model Mover as follows:

Turn off the power switch on the Stäubli CS8.



## Moving the TX90L Model Mover arm by hand

In some circumstance you need to move the TX90L Model Mover arm manually with your own hands. For example:

- Recovering from a **software lock-up**. For example if momentum has carried the arm outside the soft limits, the software might refuse to move the arm to get back inside the limits.
- Recovering from a **hardware lock-up**. If momentum or a programming error moves the arm against its internal hard limits or if the camera platform gets stuck against another part of the arm, the motors might not be able to back off from this position without tripping out.
- Putting the arm into **transport position**, to make the TX90L Model Mover volume as small as possible so it will fit into a truck. You can do this with Flair software (although you will probably need to change the soft limits) but if you forget to do so before shutting down the Flair computer then you can do it by hand.

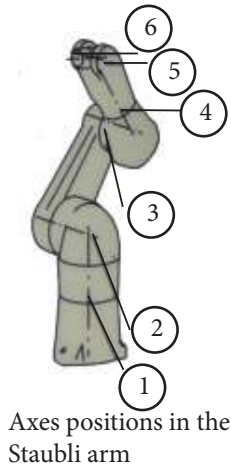
### Hint

Moving the TX90L Model Mover arm by hand is usually a two-person job — one to operate the Brake Release switch and button and one to move the arm.

To move the TX90L Model Mover arm by hand:

1. Make sure that robot itself has power and is switched on. The brakes are **on** when the unit is switched **off**, so if you want to move the arm by hand, TX90L Model Mover must have power and be switched on.
2. If the robot is connected to a running Flair PC, click on the **Disengage Robot** button in Flair.

- Person 1: Use the Brake Release Switch to select which TX90L Model Mover axis you want to move.



Brake Release Switch should be in the '0' position when not moving the robot by hand

- Person 2: By hand, securely hold the portion of the arm that you want to move so it does not fall when you release the brake.
- Person 1: Press and hold the Brake Release button.
- Person 2: Move the arm by hand.
- Person 1: Release the Brake Release button.
- Repeat steps 3 to 7 to move all the axes you want.
- When you have finished, turn the Break Release Switch to the '0' position, and power down.

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## Appendix 1 Troubleshooting

### Typical symptoms, causes, and actions

Symptoms	Cause and/or action
<p>Flair fails to establish a network connection to the TX90L Model Mover controller (the Stäubli CS8) over the <b>ETHERCAT</b> cable.</p>	<p>Try a different cable. The cable between the cifX boards in the Flair PC and Stäubli CS8 needs to be a high quality, fault-free, straight-through (that is, not cross-over) Ethernet cable.</p> <p>Check that all cables are connected correctly and that all devices, including the Ethernet hubs, have power.</p> <p>Check the order in which you are powering up the devices (page 10).</p> <p>Make sure you have allowed enough time for the TX90L Model Mover/Stäubli CS8 unit to completely power up (with the cifX board lights displaying the correct pattern) before you start Flair. If the connection is not established, try to restart nodeA in INtime (see step 4 on page 11).</p>
<p>TX90L Model Mover won't move</p>	<p>Make sure you have enabled TX90L Model Mover in Flair (click on the <b>Engage Robot</b> button).</p> <p>Make sure all of your E-stop buttons are up, and that you have pressed the Reset button on each E-stop (if it has one). When they are all up, the Stäubli CS8 panel displays a “U”.</p> <p>If you have moved the TX90L Model Mover arm by hand with the Brake Release Unit, make sure you have switch the selector knob back to 0. For details see <i>Moving the TX90L Model Mover arm by hand</i> on page 15.</p>



## Checking robot temperature using the pendant

The robots efficiency might suffer if the temperature inside the cabinet is too high. To check the temperature:

1. Replace the bypass jumper from the Pendant connector in CS8 with the Pendant connector on the teach pendant.



2. Select **Main Menu > Control Panel**. Press Enter.



3. Select **Controller Status** and press '→'.



4. The Cabinet Temperature is shown on the pendant screen.



Notes

## Appendix 2 Specifications

### Rig Weights

Dimensions	TX90L Model Mover
Weight	114kg
Power Supply Unit	50kg (110.2lbs)
Maximum camera payload	15kg

### Rig Performance

Axis	Travel	Max Speed
Rotate (Axis 1)	$\pm 180^\circ$	400°/ Second
Lift (Axis 2)	$+147.5^\circ / -130^\circ$	390°/ Second
Arm (Axis 3)	$\pm 145^\circ$	400°/ Second
Pan (Axis 4)	$\pm 270^\circ$	540°/ Second
Tilt (Axis 5)	$+140^\circ / -115^\circ$	475°/ Second
Roll (Axis 6)	$\pm 270^\circ$	260°/ Second

### Operating Envelope

Maximum reach 1.6m ca

Temperature range: 0-45 °C (32-113 °F)

Humidity tolerance: 0% to 85% relative humidity, non-condensing

**Power requirements:** 230 Volts, 16 Amps, 50-60 Hz with Earth (Ground) connection.

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**Mark Roberts Motion Control Ltd.**

Unit 3, South East Studios, Blindley Heath, Surrey RH7 6JP

United Kingdom

Telephone: +44 (0) 1342 838000

[info@mrmoco.com](mailto:info@mrmoco.com)

[www.mrmoco.com](http://www.mrmoco.com)

