



MARK ROBERTS MOTION CONTROL

BOLT MINI MODEL MOVER



QUICK START GUIDE

QSG Product Code: MRMC-2126-00

Products covered: MRMC-2123-00

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Chapter 1 Quick Start

Overview

Thank you for using the Bolt Mini Model Mover from Mark Roberts Motion Control (MRMC). Bolt Mini 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 is ideal to be used as a model mover.



Bolt Mini Model Mover's base plate can be attached to a mount of your choice such as wood top using the base clamps.

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 Bolt Mini Model Mover.

- 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 props, not people or cameras.

Assessing a site

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

- Is mount firm and level enough? The surface needs to be strong enough to take the weight of Bolt Mini Model Mover 42kg.
- Does the site have access? You need to make sure you can either push Bolt Mini Model Mover into position on its wheels or 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?
 - Bolt Mini Model Mover requires a **230V, single-phase power supply via mains power connector**.
 - The computer stack that controls Bolt Mini Model Mover (that is, the desktop computer and the ethernet relay 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 accelerations Bolt Mini Model Mover can achieve it is important that it is securely mounted, with the recommended plates and bolts to a secure and sturdy surface.
- Ensure the power supply is properly earthed (grounded) and of the correct voltage (see above).
- 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 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”.
- 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.
- 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

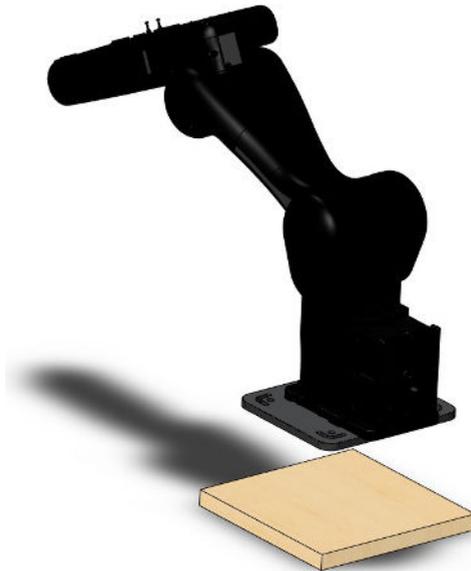
fully briefed on the safety requirements and that they know not to change their position or do anything other than the rehearsed moves without fully warning the operator. Any such person is to have a clear escape route to allow them to move safely away from the robot.

- 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.

Mounting Bolt Mini Model on a Worktop

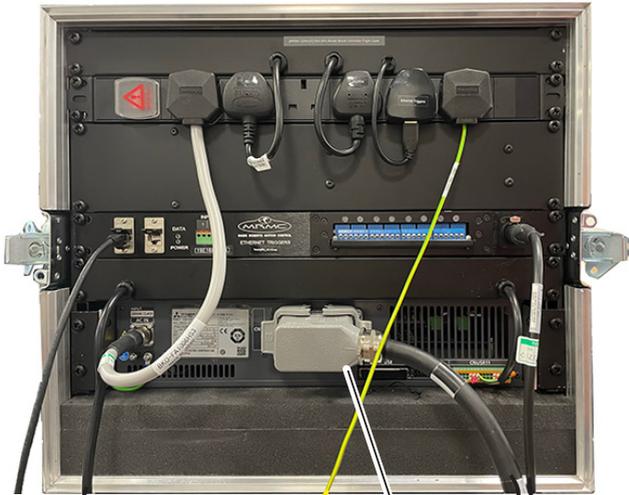
The Bolt Mini Model Mover is provided with a clamps to be mounted on a platform using the supplied base plate.

Place the robot on the worktop by aligning 2 edges of robot base plate with 2 edges of platform and secure the base plate on the platform using the supplied clamps, or any clamps sourced by you for the purpose.



Connecting the cables - As a Stand-alone Robot

Robot Controller CR800 (Rear)



Single phase power to the wall or transformer. More info on page 18

CR800 Power In

Desk E-stop box [18519]



E-stop cable [18466]

Jumper [14823]

Earth cable

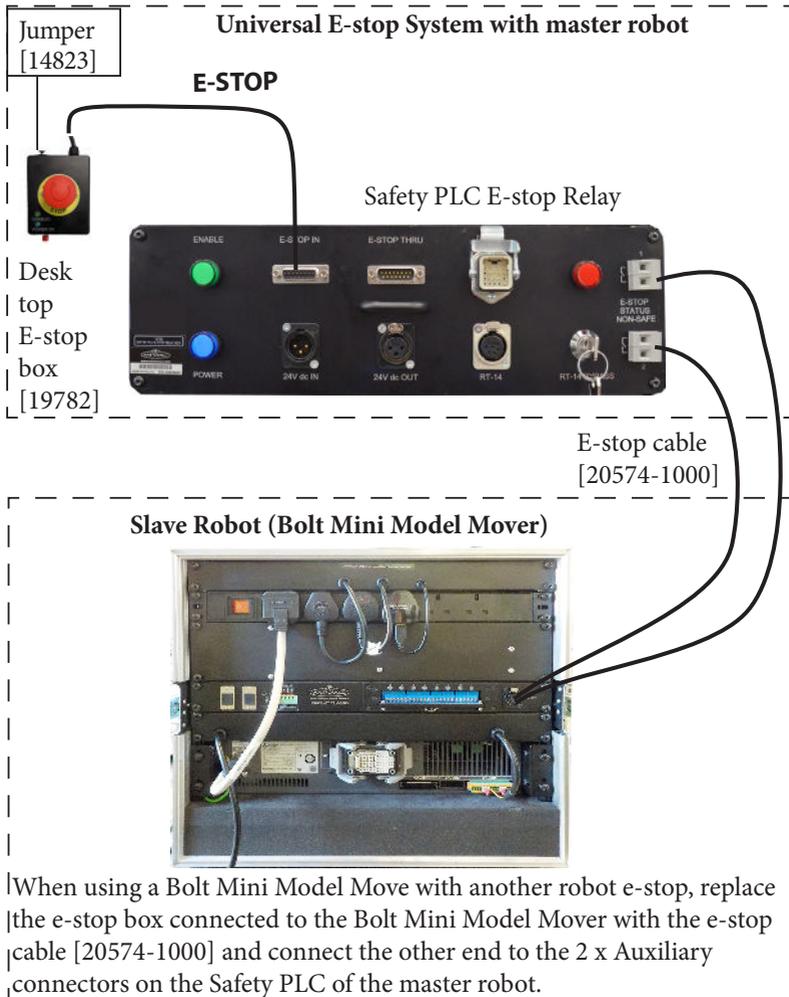


Robot Arm (Rear)



Robot Arm (Front)

Connecting Bolt Mini Model Mover with a Robot using Universal E-stop



The slave robot can be plugged to the **E-stop Status Non-safe** connectors in the Safety Relay PLC of the Master robot which provide Auxiliary relay output. Any hardware that is plugged with these two connectors will be stopped when the E-stop button connected with the Universal E-stop system is pressed but the reverse is not true. In other words, the Universal E-stop System will not accept any feedback from such devices.

Ethernet Relay Box

The purpose of this device is to trigger events on its eight relays over physical ethernet connection, it also has two inputs. The blue LED is power and green LED is for network. It works with Flair 7/ Flair Classic (but not with Flair 6). It is powered by a 5V/ 2A adapter with USB-B connector. The inputs are triggered by connecting one of the middle two (2,3) physical ports to physical pins 1 or 4, that corresponds to input 1 and 2 in Flair.



Using the trigger inputs in Bolt Mini Model Mover

The trigger inputs in the Ethernet Relay box can be used to accept trigger inputs from another device. You can wire the trigger inputs to the Ethernet Relay Box as shown in the following example for trigger input 2 (2):

Connect the trigger wires to Trigger Input 2. To activate the trigger, short these two wires.

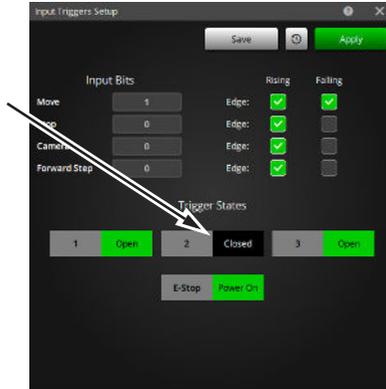


To set up Flair to initiate an action when it receives a trigger input you use the menu option **Setups > Input Triggers**. See the Flair documentation for details.

Testing the trigger inputs

You can test that the Flair software is correctly receiving trigger input signals from the Trigger Box:

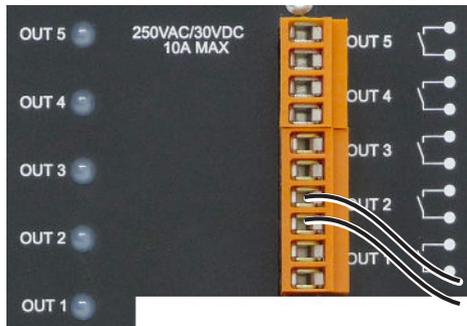
1. In Flair, use menu option **Setups > Input Triggers**.
2. Short the 2 wires connected to the trigger input post.



The corresponding numbered **Input Trigger State** in the pop-up should change from **Open** to **Closed**.

Triggering Bolt Mini Model Mover from another Robot

A Bolt Mini Model Mover can be triggered from another robot using the Trigger box trigger outputs. Connect the 2 leads from the output of the Triggers box to either input 1 or input 2 on the Bolt Mini Model Mover. Each trigger output consists of a pair of connectors, a



corresponding LED on the panel, and an internal relay. When a trigger is activated from Flair software, the relay for that pair closes, completing the external circuit and triggering the external device. The corresponding LED (also numbered **OUT 1** to **OUT 5**) is lit during activation.

For more information on how to use a Trigger Box, refer to the Trigger Box Quick Start Guide.

Starting up the Bolt Mini 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 Bolt Mini Model Mover. Put up guard rails around Bolt Mini Model Mover as necessary, and tell others on the set that you are now powering up the rig.
2. With everything powered off including the laptop, connect all cables as detailed in the diagram on page 8.
3. Power the switch on in the flight case. This will power up both the robot and the thunderbolt box.



Power switch



Hint

Ensure that the Flair PC is not plugged to the same power strip as the CR800 Controller.

The booting up sequence of the CR800 controller is as follows

Booting sequence	Time (sec)	Power	Auto	Error	Ready
1	20	I	I	I	I
2	11	I	I	I	F
3	5	I	F	F	F
4	fraction	I	I	I	I
5	3	I	I	O	O
6	3	I	O	F	O
7	7	I	F	O	F
Booting complete					

(I=On; O=Off; F=Flashing)

4. After the robot booting up is complete, power up the Flair laptop.
5. On the Flair PC, start the Flair application by double-clicking on the Flair icon on the Desktop.

Flair automatically loads the relevant firmware into all attached axis boards, including Any interface boxes or model movers that are attached to the computer stack such as Turntable.

Robot status	Power	Auto	Error	Ready
Robot engaged	I	I	F	I (Fast)
Robot disengaged	I	I	F	I (Slow)
ESTOP	I	I	F	F

6. Release the E-stop that is plugged into the CR800, by turning the button clockwise until the red button pops up.
7. In Flair, click on the **Engage Robot** button.
8. Optionally, zero the axes as required in Flair. The Bolt Mini Model Mover arm itself does not require zeroing but you need to zero other axes, such as any model mover axes like Turntable.



Bolt Mini Model Mover start-up summary

1. Secure the area
2. Switch on Bolt Mini Model Mover
3. Switch on the Flair PC
4. Check networking lights for robot in Ready state
5. Start Flair
6. Release the E-stop on the computer stack

In Flair:

7. **Engage Robot**

The rig is now ready to use.

Shutting down the Bolt Mini Model Mover system

1. If you are going to transport Bolt Mini Model Mover to a new location, put the Bolt Mini Model Mover arm into its Transport position. You can do this by using Flair (although you might have to reset the soft limits to reach the Transport position).

Bolt Mini Model Mover Transport position in Flair:

Axis	Position
Rotate	0.00°
Lift	95.4°
Arm	-69.5°
Pan	0.00°
Tilt	-116.990°
Roll	0.00°

Align the markers on the axes to bring them to packing position:



2. In the Flair software, click on the **Disengage Robot** button.
3. Press down all E-stop buttons.

4. Close the Flair software.
5. Shut down Windows on the Flair PC.



Appendix 1 Specifications

Physical and Mechanical

Temperature range: 0-40 °C

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

Total payload: 8kg

Reach radius: 0.931 m

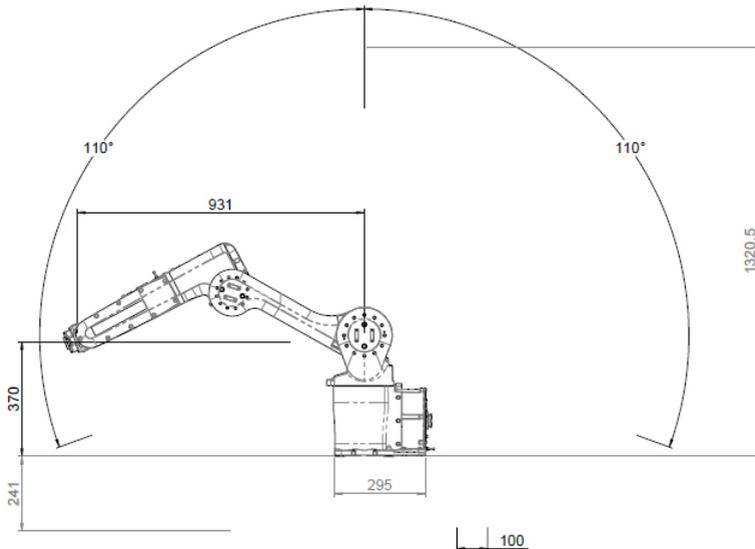
Degrees of freedom: 6

Repeatability: +/- 0.02mm

Maximum combined axis speed: 10.5m/s

Footprint: 200 x 300 mm (additional base plate: 300 x 350)

Weight: 42kg



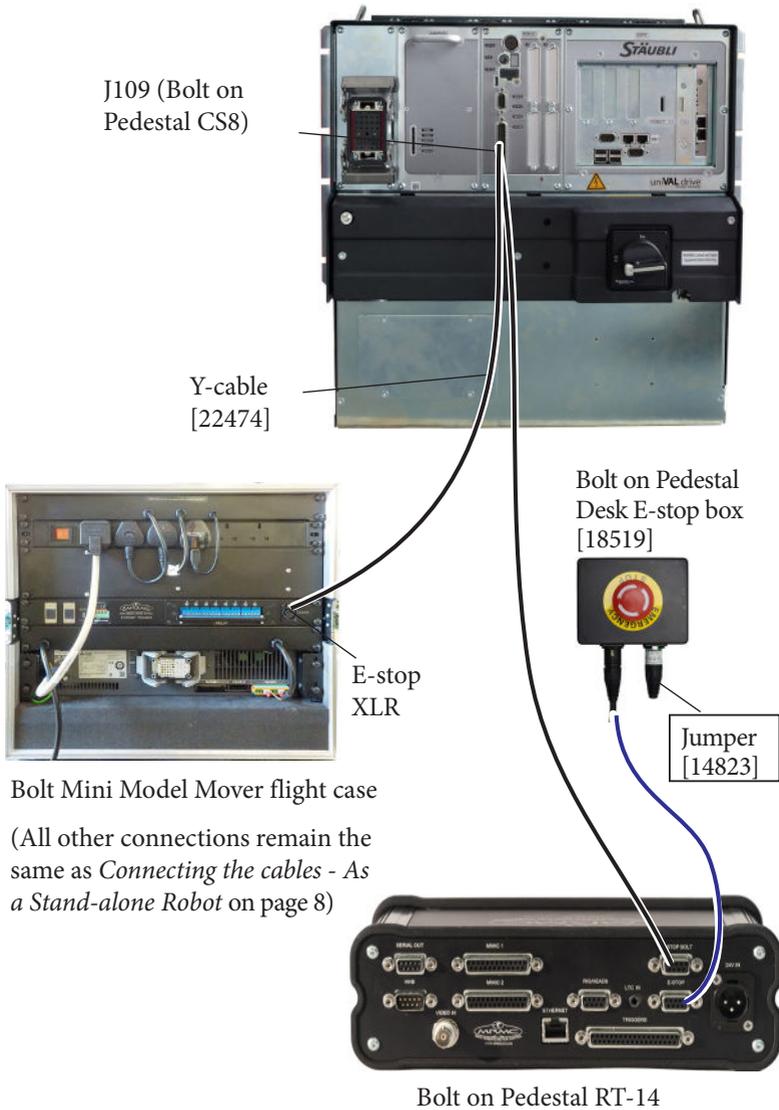
Power Requirements: 200-230V AC Single Phase

Supply Voltage	120V
Power (KVA)	2
Current (A)	8(10)
Rig Config	1+N+E
Supplied Connector	L5-15P
Transformer	2000VA 120VAC to 230VAC 
GFi	30mA

Note

The specification states that the supply should be 10A as the upper limit. The additional value is due to the inrush current at switch-on.

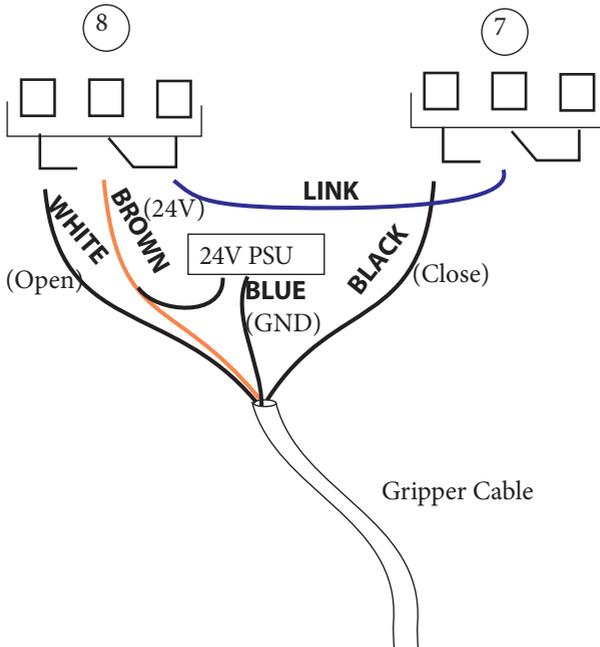
Using Bolt Mini Model Mover with Bolt on Pedestal E-stop



Notes

Appendix 2 Optional Accessories

Gripper Cable - Ethernet Relay Box Connections



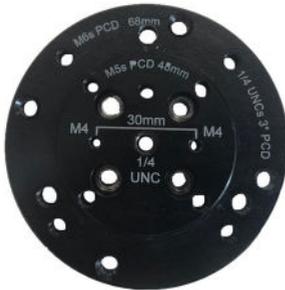
Chucks



Keyless chuck for small objects



Key chuck for larger objects



Adapter Plate



Use the 3 x M6 threaded holes in the adapter plate to mount the key chuck on the robot arm.

Use the 4 x M4 holes in the keyless chuck to mount it directly on the robot arm.



Notes



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