MARK ROBERTS MOTION CONTROL

RV13 MODEL MOVER

QUICK START GUIDE

QSG Product Code: MRMC-2089-00
Products covered: MRMC-2256-00

CRANES AND RIGS | BROADCAST | HEADS & DSLR | PRODUCT PHOTOGRAPHY | RENTALS

RV13 Model Mover Quick Start Guide

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Overview

Thank you for using the RV13 Model Mover from Mark Roberts Motion Control (MRMC). RV13 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.

RV13 Model Mover has a stationary base which you either hold down with weights or, for more permanent installations, attach to the floor.

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 RV13 Model Mover.

- Unlike traditional motion control equipment, RV13 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. Additional safety steps should be taken prior to using a rig to carry people.

Assessing a site

Before setting up RV13 Model Mover you need to **assess the site**, paying particular attention to the following points:

- Is the ground or floor firm enough and level enough? You might have to use boards or bricks to create a level surface. The surface needs to be strong enough to take the weight of RV13 Model Mover 264kg plus weights 280kg of weights (2x140kg).
- Does the site have access? You need to make sure you can either push RV13 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?
  - RV13 Model Mover requires a **230V, single-phase power supply via a 16Apower connector**.
  - The computer stack that controls RV13 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.

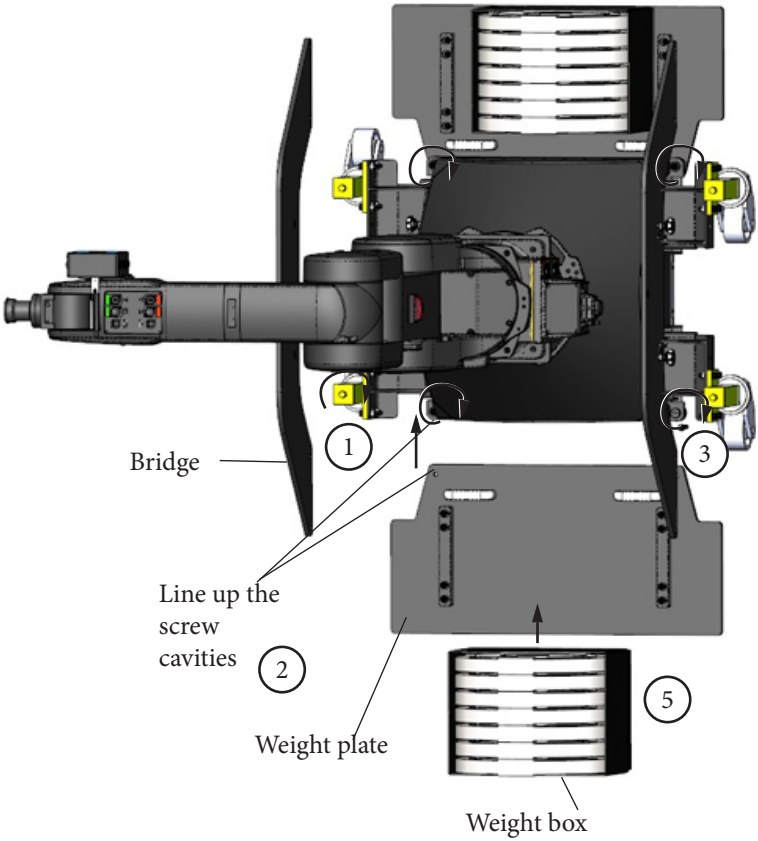
Operational safety

- 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.

Mounting the Weight Plates



1. Use the jack screws on the castor wheels to lift the base high enough to insert each of the weight plates on either side of the RV13 Model Mover Base lining up the screw cavities.
2. Lower the base close to the wing but not quite resting on it, close enough for the two retaining bolts to reach the wings through the base.
3. Lower the base completely so it is resting on both wings. Secure the weight plates using the 2xM10 screws on either plate. The screws

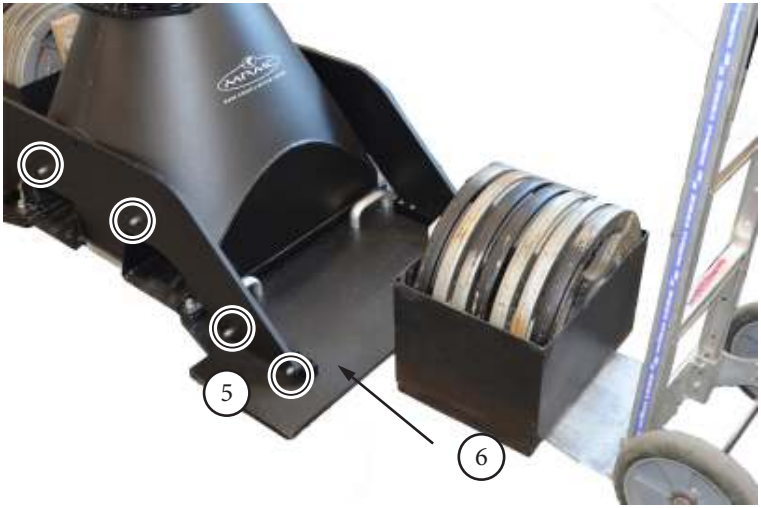
should be wedged to the ground to secure the weight plate completely.

4. At this point, you can remove the castor wheels.

5. Attach the bridges with two weight plates on one side using the 4xM10 screws that attach to the weight plates and 2xM10 screws that attach to the pedestal base.

   Repeat this to secure the bridge on the opposite side.

6. Put the weights onto the wings. RV13 Model Mover requires 2 boxes of weights — one on each side. Each box contains 140kg of weights (7 × 20kg).



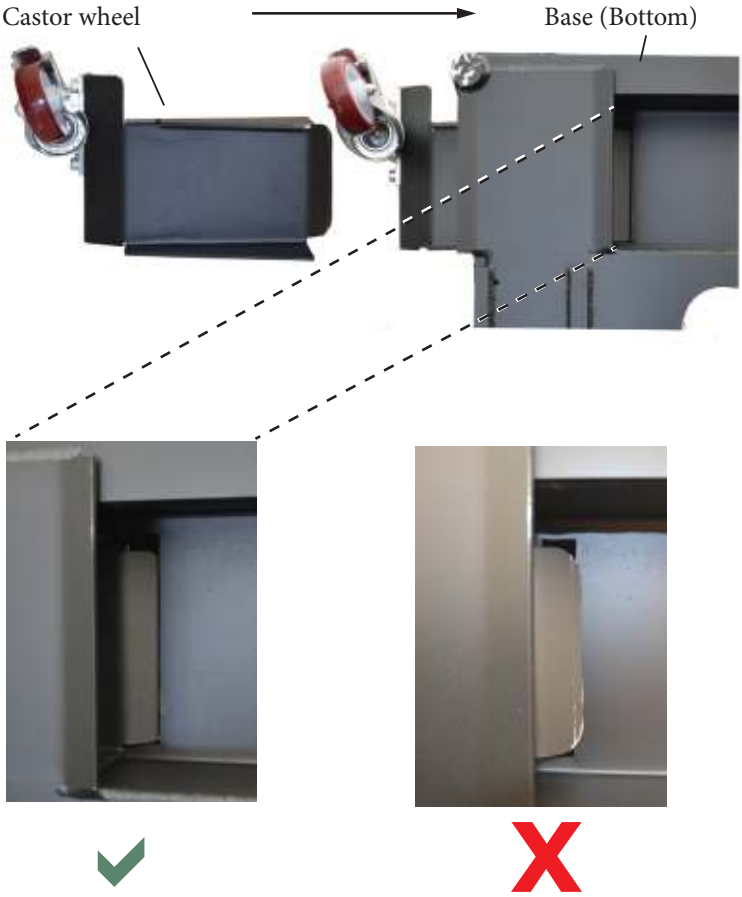
Hint

You can use a pallet truck to move RV13 Model Mover without removing the wings and bridges if you want, as long as you take the weights off first.

Mounting the Castor Wheels

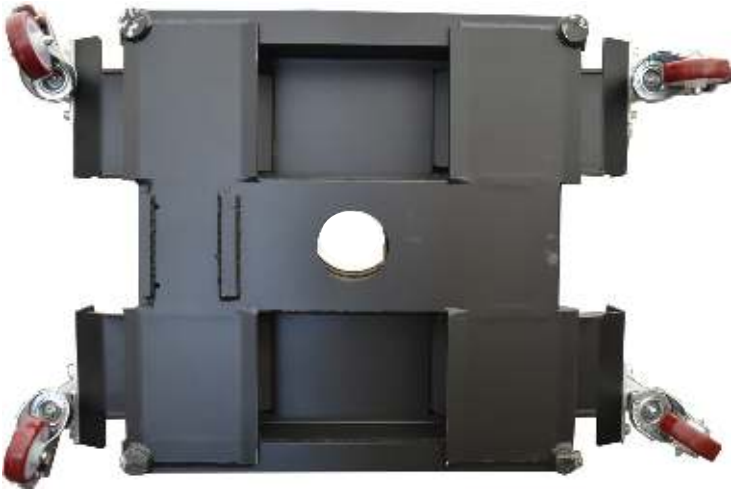
If you need to move the RV13 Model Mover around, use the following procedure to mount the castor wheels:

1. Remove the bridge plates.
2. Slide one castor wheel into the base ensuring that edge of the plate in the wheel assembly is inserted in the slot in the base.



Note that the wedge in the castor plate should be slotted properly under the base.

3. Similarly insert all the castors into the base ensuring the plates are inserted into the slots.



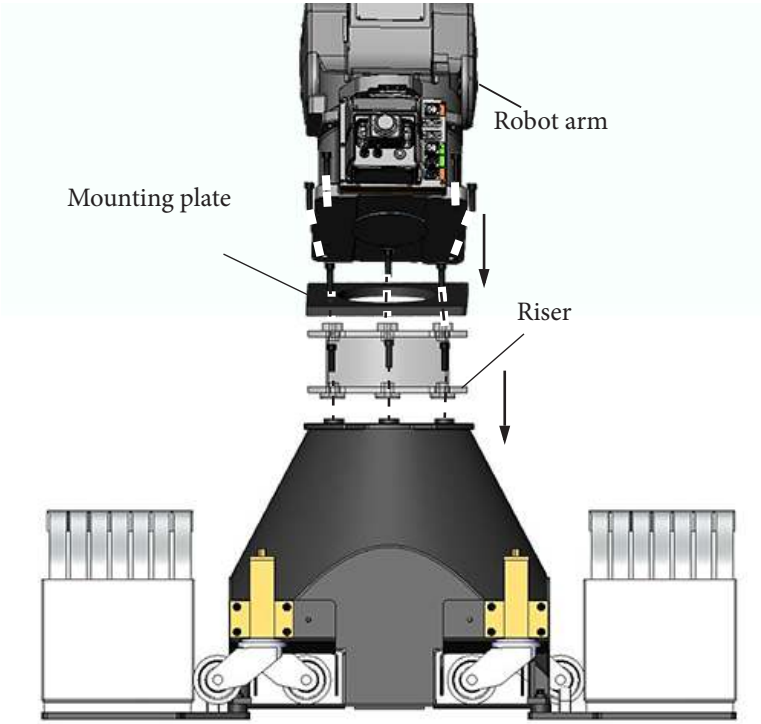
4. Secure and tighten the castor wheels to the base and use the four jack screws to lift it off the floor (24mm socket/wrench).

Notes

Mounting the Optional Riser(s)

RV13 Model Mover can include optional risers if higher arm reach is required. These come in two sizes: 150mm and 300mm; either or both of them can be used. Use the following instructions to mount any riser on the pedestal:

1. Remove the arm from the base by unscrewing the 4xM12 screws and using a gantry hoist to lift the arm.
2. Remove the mounting plate from the base by unscrewing the 3xM12 screws.
3. Lower the riser on the base aligning the three screw cavities and tighten the 3xM12 screws to secure the riser on the base.
4. Mount the mounting plate on the riser using 3xM12 screws.
5. Carefully lower the arm on the base aligning the screw cavities on the mounting plate and those on the robot arm. Screw 4xM12 to secure the arm on the base.



Note

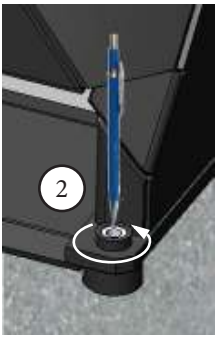
If you are using the 300mm riser, anchor the RV13 Model Mover down to the floor. Refer to the next section for details.

Limitations when using weights

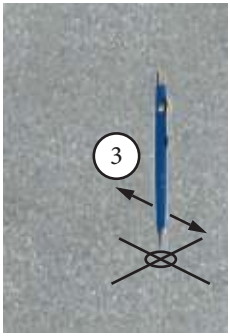
If you are using weights, reduce the top-speed by 50% when you have the 300mm riser added. With the small riser, reduce the speed by 25%. If you are using both the risers together, then the rig can only be used at slow speeds.

Anchoring RV13 Model Mover to the floor

If you are setting up RV13 Model Mover in a permanent (or semi-permanent) location, you can anchor the pedestal to the floor as an alternative to holding it down with weights. The following procedure tells you how to anchor the pedestal to a concrete floor.



× 4 corners



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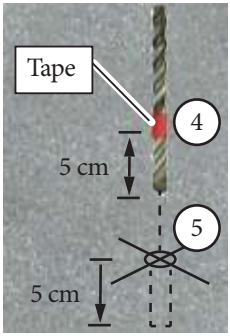


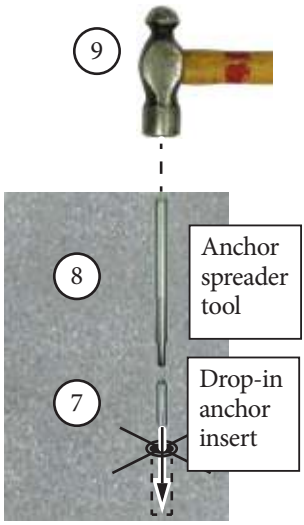
× 4 corners

1. Wheel the RV13 Model Mover to the spot where you want to bolt it to the ground and lower it using the jacks on the castor wheels.
2. At one corner of the pedestal, use the hole to draw a circle on the concrete with a pencil, to mark the position of the hole. You can use either hole.

   Repeat for the other three corners of the pedestal.
3. Temporarily remove RV13 Model Mover (jack the castor wheels up) and at the four circles that you have drawn, draw cross centred on the circle, to help you precisely locate the drill bit.
4. On the 15mm diameter drill bit, put tape around the bit 5 cm from the tip. This will help you gauge the depth of the hole in the next step.
5. At one of the corner circles, drill a hole 5 cm deep into the concrete, centred on the cross. When the tape on the drill bit reaches the floor, drilling is complete.

   Repeat for the other three corners.
6. Clean the four holes.

7. At one of the holes insert the drop-in anchor insert, threads upward, all the way to the bottom.
8. Insert the anchor spreader tool into the drop-in anchor insert.
9. Hit the top of the anchor spreader tool with a hammer until the anchor is fully spread in the concrete.
10. Remove the anchor spreader tool.
11. Repeat steps 7 to 10 for the other three corners.
12. Put RV13 Model Mover in place over the holes.
13. Insert the four retaining bolts through the corners of the base and into the drop-in anchor inserts, and tighten.



× 4 corners

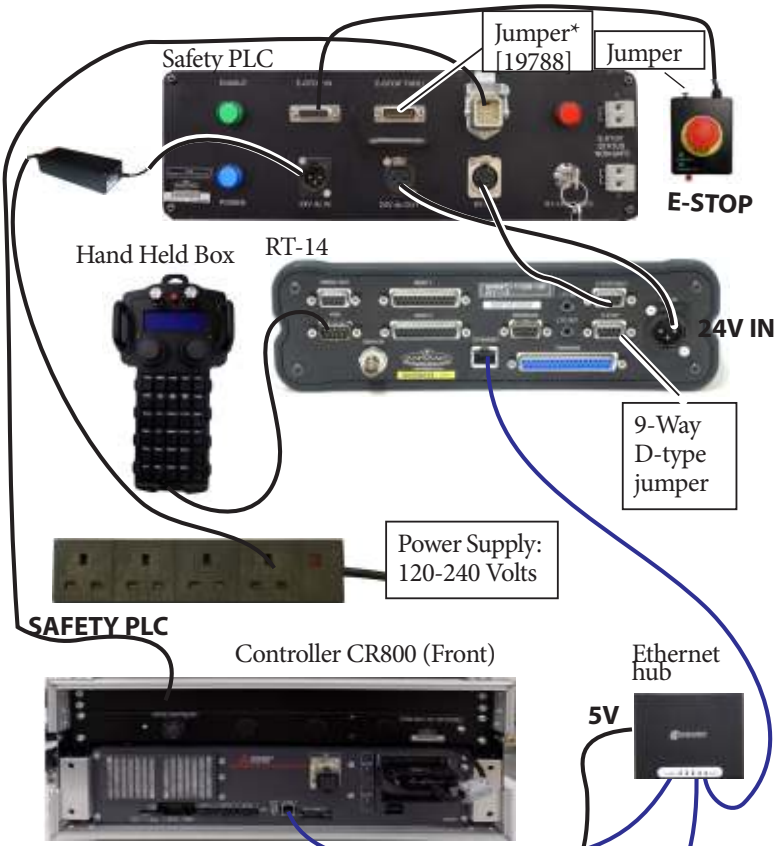
Connecting the cables

Robot Arm (Rear)

Robot Controller CR800 (Rear)

Single phase AC 200 to 230V

POWER



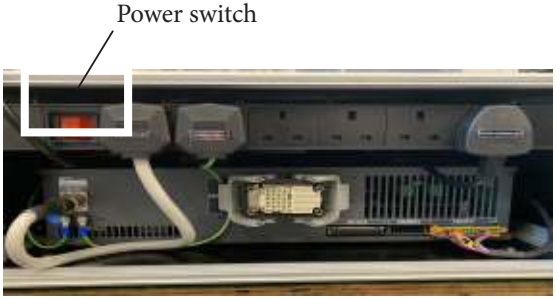
The **Jumper*** only applies when you are using the Model Mover as a single robot system. For more information, refer to Universal E-stop System Quick Start Guide.

Starting up the RV13 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 RV13 Model Mover. Put up guard rails around RV13 Model Mover as necessary, and tell others on the set that you are now powering up the rig.

2. Power up the CR800 controller. Wait for the robot to boot up for a few seconds.



Hint

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

The RV13 Model Mover start up sequence on the CR800 controller (digits on front panel)

	Power	Auto	Error	Ready	LAN
Power up	I	I	I	I	
	I	I	I	F	
	I	F	F	F	
	I	I	I	I	

	Power	Auto	Error	Ready	LAN
	I	I	O	O	
	I	O	F	O	
	I	F	O	F	
Loading Flair	I	I	F	I	
	I	I	F	I	F (Flair Running and Enabled)
	I	I	O	F (Robot enabled)	

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. 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

5. Once the CR800 start-up sequence is complete, 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.

ENABLE button

6. Zero the axes as required in Flair. The RV13 Model Mover arm itself does not require zeroing but you need to zero other axes such as:
    - Any external Lens Control Motors (LCMs) that you are using. To zero these you first set the **focus to infinity** (∞), **zoom to wide-angle** (zoomed out all the way), **iris/aperture to wide open** and then use the relevant **Zero > Direct Zero Axis** menu option to set those lens positions as the zero points in Flair.
    - Any model mover axes like Turntable.
7. In Flair, click on the **Engage Robot** button.
8. In Flair, move the RV13 Model Mover arm to its home position (rotated straight forward and tucked under).
9. Set the soft limits for the rig axes in Flair as required:
    - Any model mover limits
    - It is not recommended that you change the soft limits on the arm; if not done correctly it can lock up the arm.

RV13 Model Mover start-up summary

1. Secure the area
2. Switch on RV13 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**
8. Home the arm, carefully
9. Set the soft limits

The rig is now ready to use.

Shutting down the RV13 Model Mover system

1. Move RV13 Model Mover to its Home position, for both the arm.

   or...

   If you are going to transport RV13 Model Mover to a new location, put the RV13 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).

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.

RV13 Model Mover Transport position:

- Arm rotated forward and tucked under.
- Arm about 45 degrees to base slope, above the wheel unit, with about 12cm clearance between it and the base.

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Appendix 1 **Specifications**

Rig Weights

Dimensions	RV13 Model Mover
Total weight	542kg
Weight- Arm	132kg
Weight - Base	80kg (including weight plates and bridges)
Weight - Anchor weights for each side of base when base not secured to ground	2x140kg
Maximum payload	10kg (28.6lbs)
Castor wheels	20kg

Rig Performance

Axis	Travel (degrees)	Max Speed (degrees/s)
Rotate	370(±185)	234
Lift	230 (-55 to +175)	164
Arm	160 (-65 to +95)	219
Pan	390 (±195)	375
Tilt	230 (-205 to +25)	375
Roll	1420(±710)	720

Note

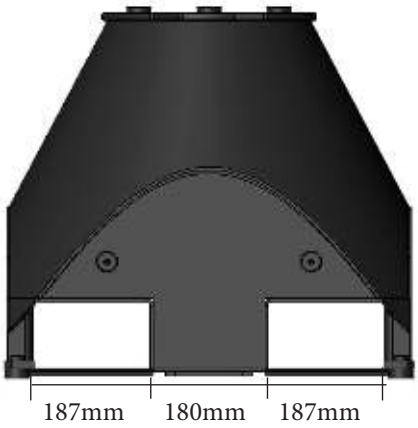
The Roll limits can be extended further but will require caution for the external cables

Operating Envelope

Maximum Height (From Ground)	2500mm / 8’ 2”
Lowest Position	0mm / 0’
Maximum reach (from rotate centre)	1475mm / 4’1”

Temperature range: 0-40 °C
Humidity tolerance: 0% to 85% relative humidity, non-condensing

Bolt Base Cavities Dimensions



Power Requirements

Power supply: Single phase Line+Neutral+Earth

Voltage: 200-230 Volts with 10% tolerance

Current: 2x16A; Peak current: 22.5A

Frequency: 50-60 Hz

The CR800 controller is supposed to be installed and used in the customer’s system. Supply the primary power of the controller from system. In addition, provide a safety device (eg earth-leakage current

breaker) that can shut off the power of the controller in the customer's system. When using an earth-leakage current breaker as a safety device, select the product that meets the following specifications:

Item	Unit	Specification
Rated voltage	V	AC200 to 230
Rated sensitivity current	mA	30 or more
Rated current	A	10 or more

RV13 Model Mover power requirement: 4KVA

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Appendix 1 **RV13 Model Mover Panel**

Ulti-box connector summary

The Ulti-box that is mounted on the arm is a multi-purpose interface box that is used to control servo motors on many MRMC heads and Lens Control Motor (LCM) units. The Ulti-box offers versatile connections for many camera and lens configurations although some of the axes connectors such as **PAN**, **TILT**, and **DATA** are not ordinarily used in the context of RV-30 Model Mover, as the robot itself provides these features.

1. **PAN** connector for the Pan servo motor on a head. For pin-out information see *Servo motor connector* on page 35.
2. **PROG** serial connector for connection to a controller using a Serial RS232 connection (as an alternative to an Ethernet or DataLink

connection), and for updating the firmware in the Ulti-box. For pin-out information see *Program serial connector* on page 35.

3. **POWER** DC input for the Ulti-box and its attached devices. The standard unit uses a power input of 24-36 Volts. The high-power variant (marked **HV**, for **H**igh **V**oltage) uses 24-48 Volts. For pin-out information see *Power connector* on page 36.

4. **CAM ACC** Camera Accessory input/output connector. It has pins for three stepper motors, two serial lens controls, two trigger in controls, and two trigger out controls. For pin-out information see *Camera Accessory connector* on page 36.

5. **DATA** DataLink In (Up Link) connector for controlling the Ulti-box and its attached devices using a DataLink connection, as an alternative to an Ethernet or Serial RS232 connection. You connect this to a device that is further up the DataLink daisy-chain, such as:

   - The **DATA OUT** (or **DOWN LINK**) connector on a controller such as the MSA-20 Handwheels or Large Format Panel (LFP).
   - The **RIG/HEAD** connector on an RT-14 interface box which is in turn connected to a PC running Flair Motion Control Software.

   Note that because there is no DataLink Out connector on the Ulti-box, the Ulti-box must be connected at the end of the DataLink daisy-chain rather than the middle. For pin-out information see *Data In connector* on page 37.

6. **ETHERNET** RJ45 connector for controlling the Ulti-box and its connected devices from a Flair PC. This Ethernet port is rated at 100 Mbits/sec but can operate at lower speeds of 10 Mbits/sec or less.

7, 8. **ZOOM**, **FOCUS** connectors for external servo LCMs mounted on the camera platform. For pin-out information see *Servo motor connector* on page 35.

9. **TILT** connector for a Tilt servo motor on a head. For pin-out information see *Servo motor connector* on page 35.

10, 11. **AUX-1**, **AUX-2** connectors for control of auxiliary servo motors. For pin-out information see *Servo motor connector* on page 35.

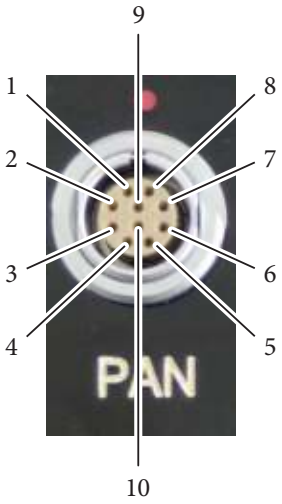
> Note
>
> Connectors 1, 7, 8, 9, 10 and 11 are identical and are labelled only for ease of use.

Ulti-box connector pin-out information

Servo motor connector

This type of connector is used for six servo motor connectors on the Ulti-box: Pan, Zoom, Focus, Tilt, Aux-1, Aux-2.

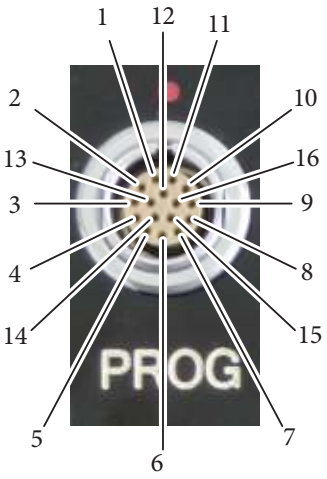
1. DATUM
2. A+
3. B+
4. Z+
5. N/C
6. MOTOR_B
7. MOTOR_A
8. LIMIT
9. +5V
10. GND



Program serial connector

Serial connector for connection to a controller using a **Serial RS232** connection, and for updating the firmware in the Ulti-box.

1. SerialTxA
2. SerialRxA
3. +5V
4. FGPIO
5. DSP_TRSTN
6. TCK
7. TMS
8. DSP_TDI
9. DSP_TDO
10. DSP_EMU0
11. DSP_EMU1
12. FPGA_TDI
13. FPGA_TDO
14. BOOT_SEL
15. +3.3V
16. GND



Power connector

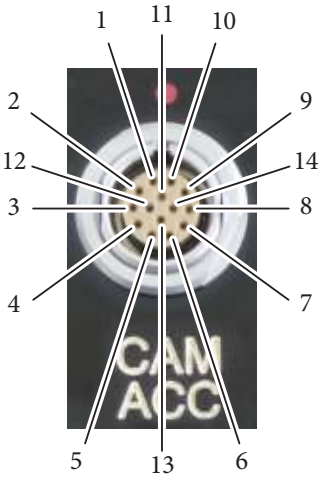
The power input connector for the Ulti-box. For usage see page 33.

1. GND
2. GND
3. +35V for Basic and +48V for HV
4. +35V for Basic and +48V for HV

Camera Accessory connector

This is a multi-purpose camera accessory connector with connections for three stepper motors, two serial lens controls, two trigger in controls, and two trigger out controls.

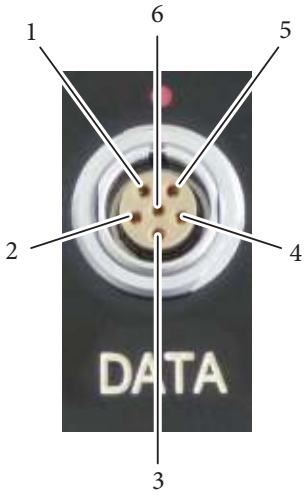
1. Step1
2. Gp2In (Trigger In 2)
3. Step2
4. SerialTxB serial lens control
5. Step3
6. SerialRxB serial lens control
7. Dir3
8. GND
9. +5V
10. Gp1In (Trigger In 1)
11. Dir1
12. Dir2
13. Gp2Out (Trigger Out 2)
14. Gp1Out (Trigger Out 1)



Data In connector

This is a DataLink In connector for connection to a controller using a DataLink connection. DataLink In (Up Link) connector for connection to a DataLink device higher up in the DataLink daisy-chain. For usage see. page 33.

1. Watchdog–
2. Link1Out–
3. Link1Out+
4. Link1In–
5. Link1In+
6. Watchdog+



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Notes

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