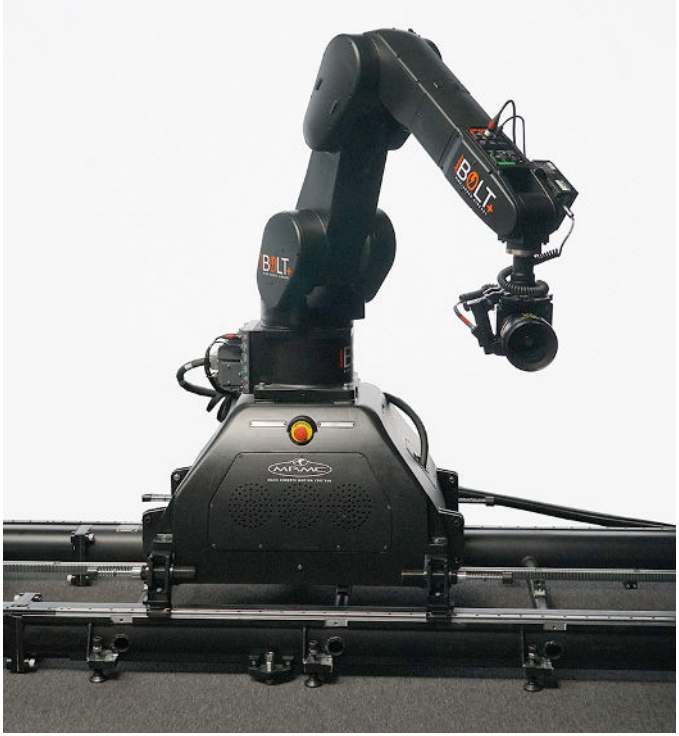
MARK ROBERTS MOTION CONTROL

BOLT™ JR+

COMPACT LIGHTWEIGHT HIGH SPEED CINEBOT™ RIG



QUICK START GUIDE

QSG Product Code: MRMC-2257-03
Products covered: MRMC-2083-00, MRMC-2050-00

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

Bolt™ Jr+ Quick Start Guide

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Chapter 1 **Quick Start**

Overview

Thank you for using the Bolt™ Jr+ Cinebot™ rig from Mark Roberts Motion Control (MRMC). Bolt Jr+ 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. There are two versions of Bolt Jr+:

Bolt™ Jr+ on Track has a base designed for moving along Precision Track, which can be bolted to the ground and can also be held down with weights at temporary locations. It has removable trolley wheels for moving between sets.

Bolt™ Jr+ on Pedestal 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, including high speed track

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 Jr+.

- Unlike traditional motion control equipment, Bolt Jr+ 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.

⇔ If you are using Bolt Jr+ on Track, you need to take extra steps during installation and use due to the additional risks involved in using track. See the separate *Precision Track Quick Start Guide* for information on laying the track, securing it to the floor, and mounting Bolt Jr+ onto it. The notes given below for track users are marked with this symbol: ⇔.

- 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 Bolt Jr+ 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 Bolt Jr+ itself (390kg) plus the weight of the track (95 kg per section) or for Bolt Jr+ on Pedestal 264kg plus weights 280kg of weights (2x140kg).
- Does the site have access? You need to make sure you can either push Bolt Jr+ 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?
  - The BOLT Jr+ on Track is delivered with **2 x power cables and is designed to run from 2x240VAC 15A supplies only. Both cables must be used.**
  - Bolt Jr+ on Pedestal requires a **230V, single-phase power supply via a 13Apower connector**.
  - The computer stack that controls Bolt Jr+ (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.

⇔ When using track, ensure that it is properly bolted to the floor. If bolting the track is not possible, use 140kg of counter weights on each corner of the track totalling to 560kg.

⇔ Make sure there is plenty of clearance around the length of the track 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 track or robot as it moves along the full length.

- 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.

⇔ Never let anyone cross the robot's track when the track motor is powered up. In fact, it is a good idea to get into the routine of walking around the track instead of over it so that you don't cross the track out of habit 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 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.

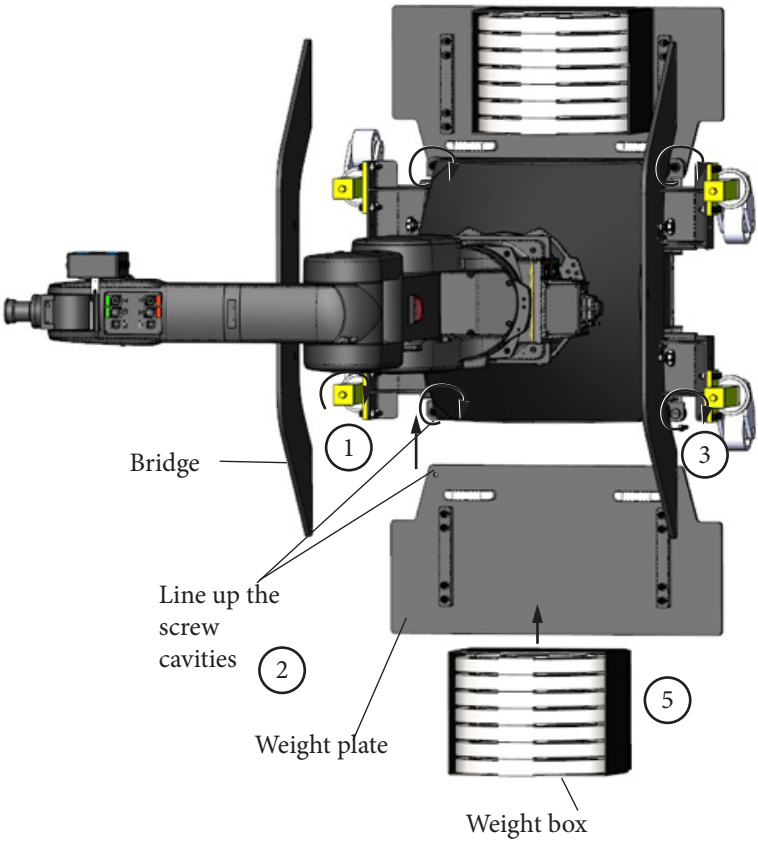
- Always loudly and clearly indicate to others when the rig is about to move. Shout “Rig Moving!” if no other means exists.

⇔ 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 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 (Bolt™ Jr+ on Pedestal)



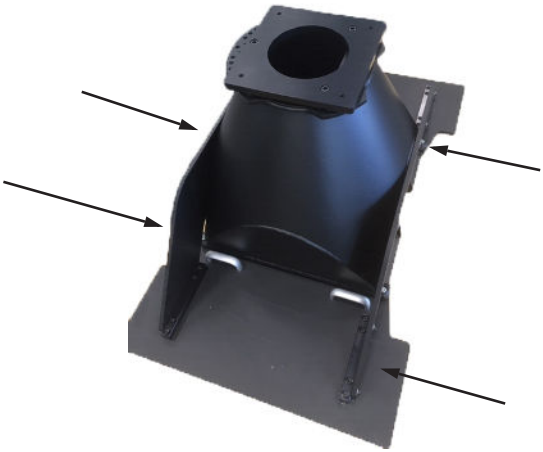
1. Use the jack screws on the castor wheels to lift the base high enough to insert each of the weight plates on either side of the Bolt Jr+ Base lining up the screw cavities.
2. Lower the base close to the wing but not quite resting on it, close enough for the two retaining bolts to reach the wings through 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.

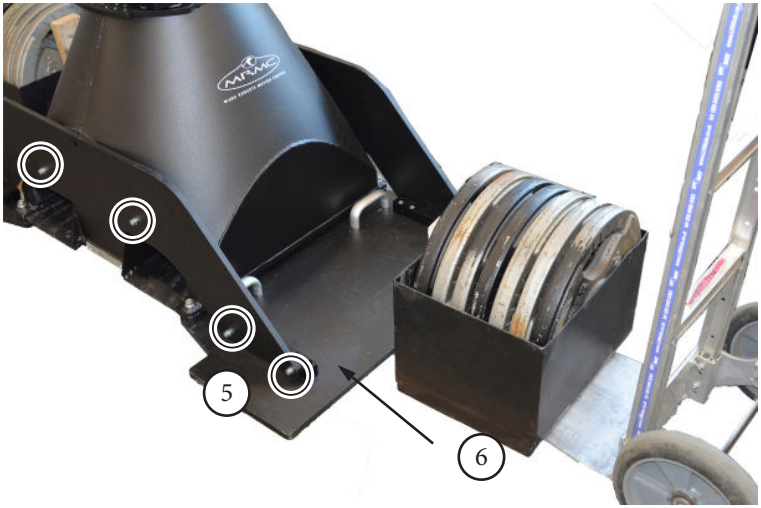
4. At this point, you can remove the castor wheels.

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. Bolt Jr+ requires 2 boxes of weights — one on each side. Each box contains 140kg of weights (7 × 20kg).



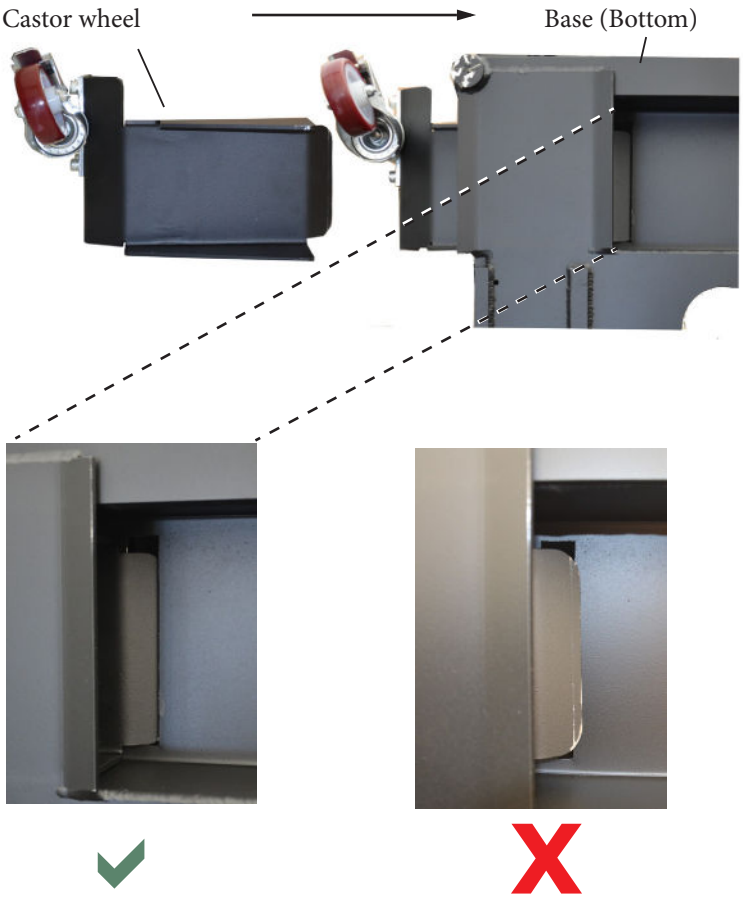
Hint

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

Mounting the Castor Wheels (Bolt™ Jr+ On Pedestal)

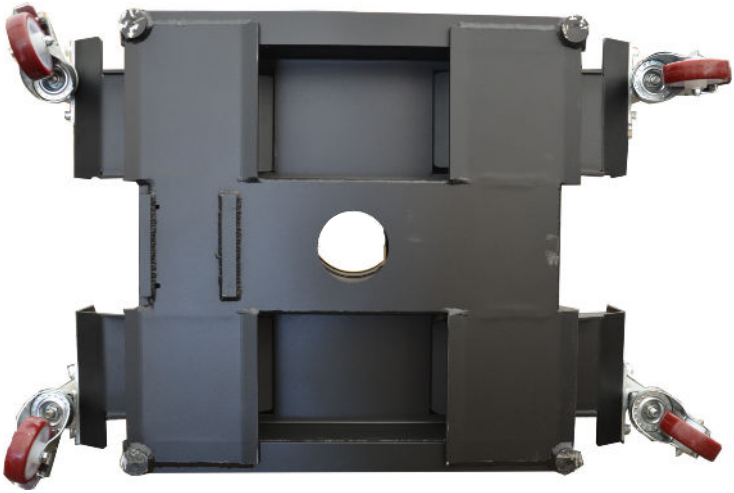
If you need to move the Bolt Jr+ on Pedestal around, use the following procedure to mount the castor wheels:

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.



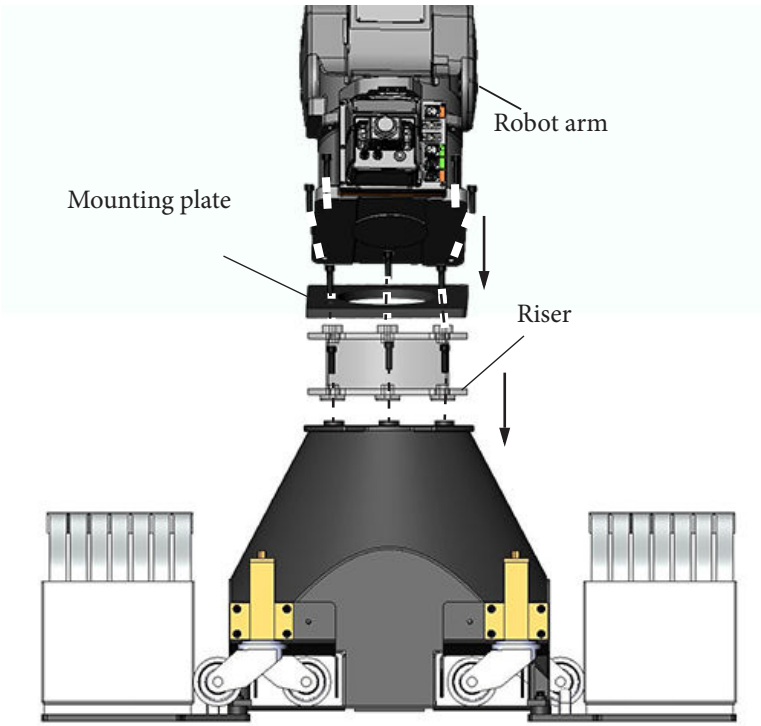
4. Secure and tighten the castor wheels to the base and use the four jack screws to lift it off the floor (24mm socket/wrench).

Notes

Mounting the Optional Riser(s)

Bolt Jr+ 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

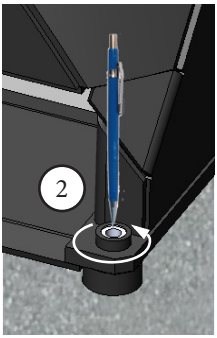
If you are using the 300mm riser, anchor the Bolt Jr+ on Pedestal down to the floor. Refer to the next section for details.

Limitations when using weights

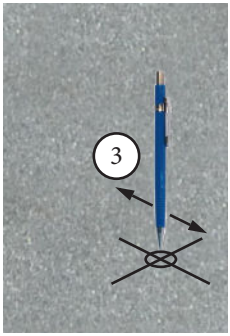
If you are using weights, reduce the top-speed by 50% when you have the 300mm riser added. With the small riser, reduce the speed by 25%. If you are using both the risers together, then the rig can only be used at slow speeds.

Anchoring Bolt™ Jr+ on Pedestal to the floor

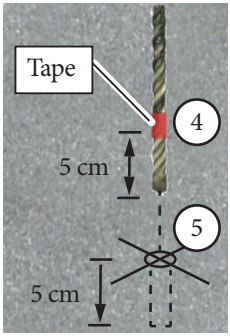
If you are setting up Bolt Jr+ on Pedestal in a permanent (or semi-permanent) location, you can anchor the pedestal to the floor as an alternative to holding it down with weights. The following procedure tells you how to anchor the pedestal to a concrete floor.



× 4 corners



× 4 corners



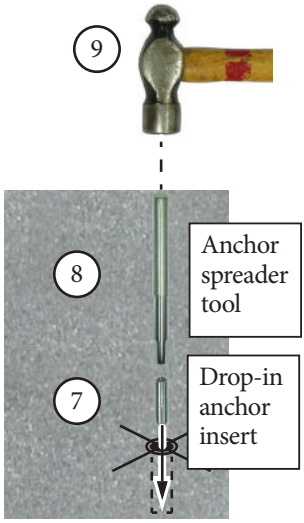
× 4 corners

1. Wheel the Bolt Jr+ on Pedestal 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.

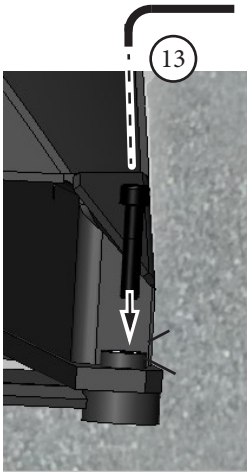
   Repeat for the other three corners of the pedestal.
3. Temporarily remove Bolt Jr+ on Pedestal (jack the castor wheels up) and at the four circles that you have drawn, draw cross centred on the circle, to help you precisely locate the drill bit.
4. On the 15mm diameter drill bit, put tape around the 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 Bolt Jr+ on Pedestal 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.



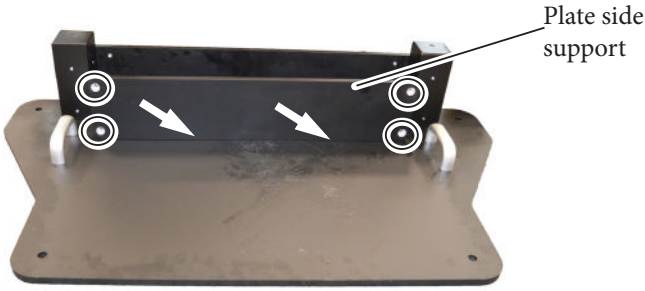
× 4 corners



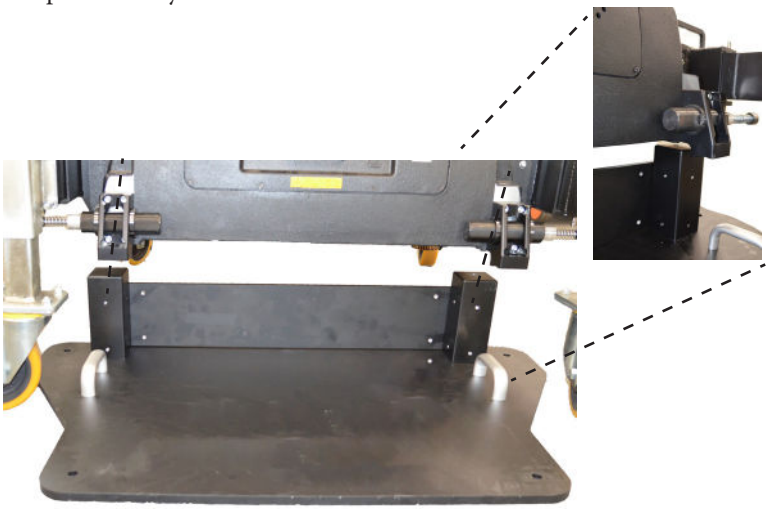
Mounting Weight Plates on Bolt Junior+ On Track

Bolt Jr+ on Track can used off the track with the base mounted on the weight plates.

1. Release the 2 x plate side supports from the 2 x weight plates by unscrewing 4xscrews.

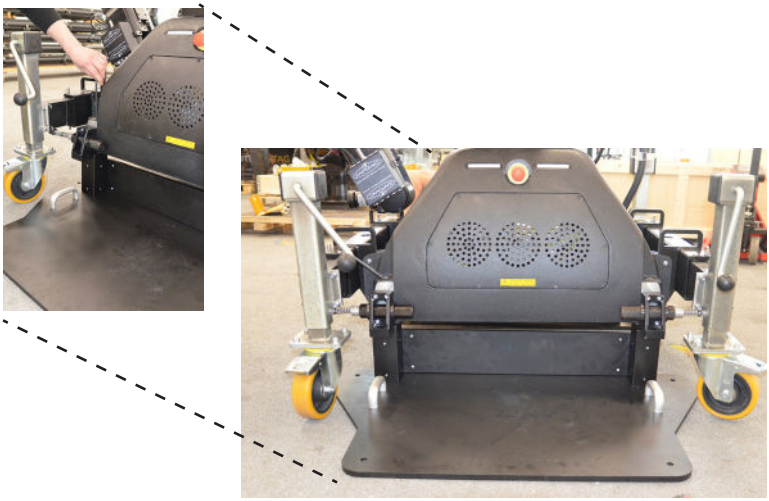


2. Raise the Bolt Jr+ Base by jacking up the castors. Place the weight plate under the side of the Bolt Jr+ base so that the screw cavity in the plate lines up with the captive screw in the Bolt Jr+ base. Two persons may be needed to do this.



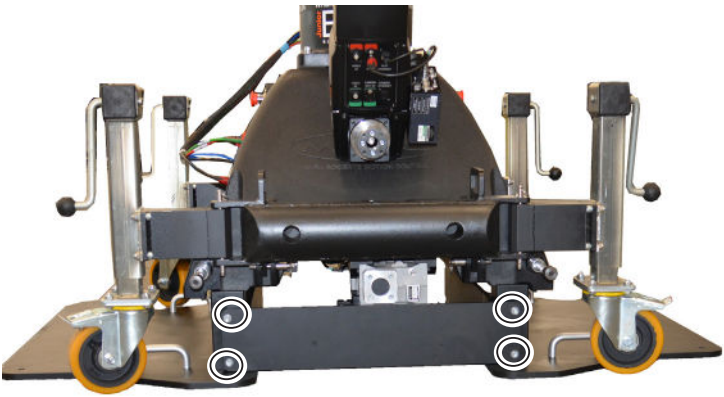
3. Similarly line up the second weight plate under the opposite side of the Bolt Jr+ base.

4. Lower the Base on one side to align the screw with the plate cavity. Nipping the spring in the screw will help with proper alignment. Once aligned lower the Base completely and tighten the screw.

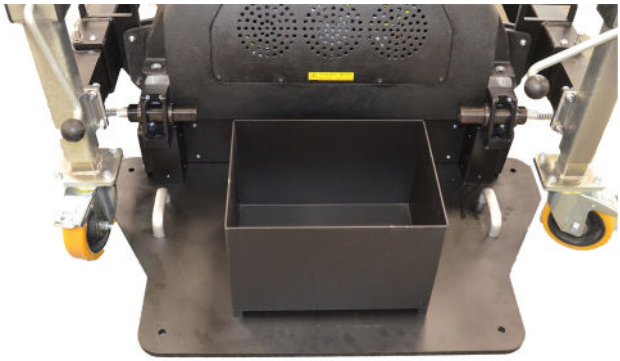


5. Similarly, mount the weight plate on the opposite side.

6. Mount the plate side supports by tightening the 4 x screws.



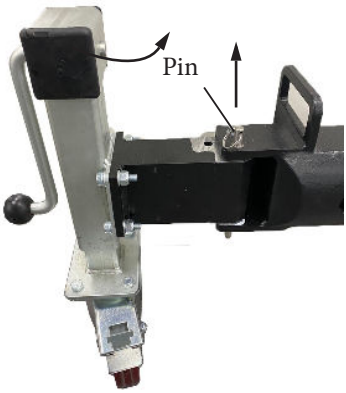
7. Similarly, mount the plate side support on the opposite side. Then, place the weight each plate add 140kg of weights on each weight bucket.



Modifying Wheel Orientation

If the Bolt Jr+ is required to be wheeled through narrow doorways or corridors, the wheel orientation can be changed to wheels in.

Simply pull the pin out to release the wheel from the beam and swivel it left or right, as required. Reattach the pin to secure in position.

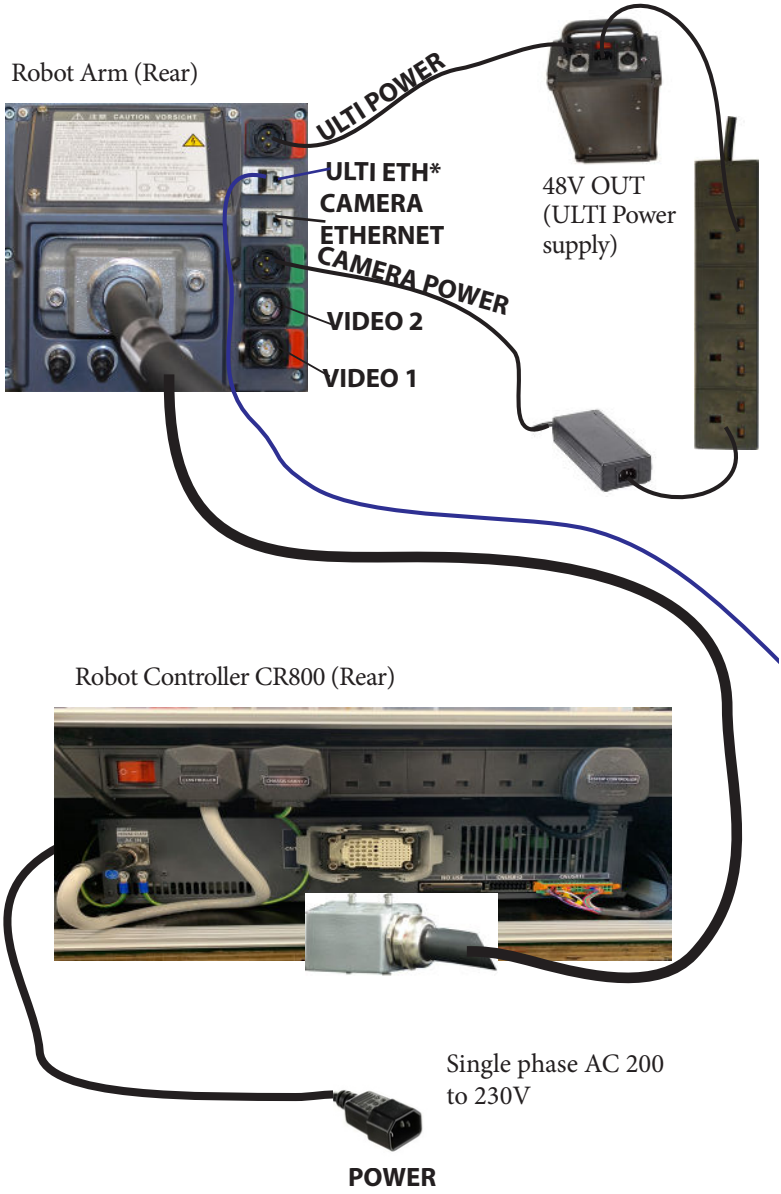


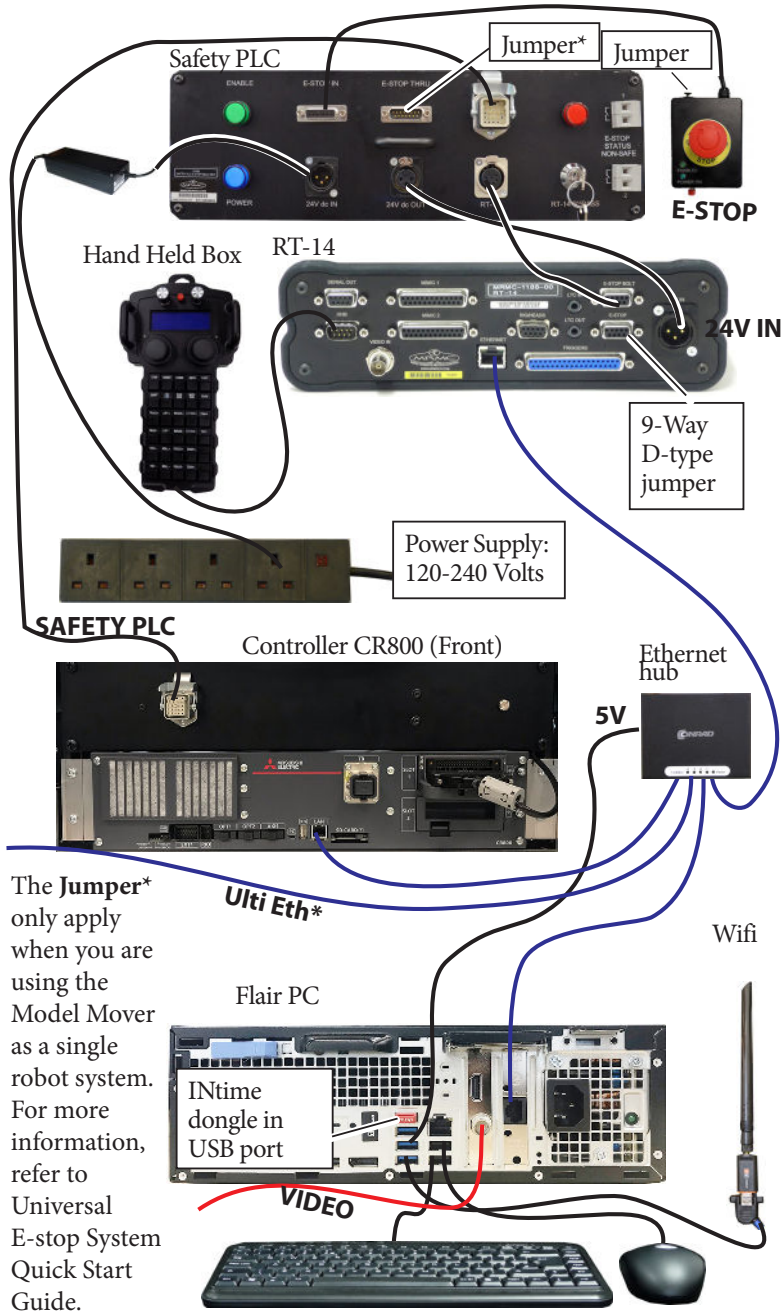
Castor wheels out

Castor wheels in

Notes

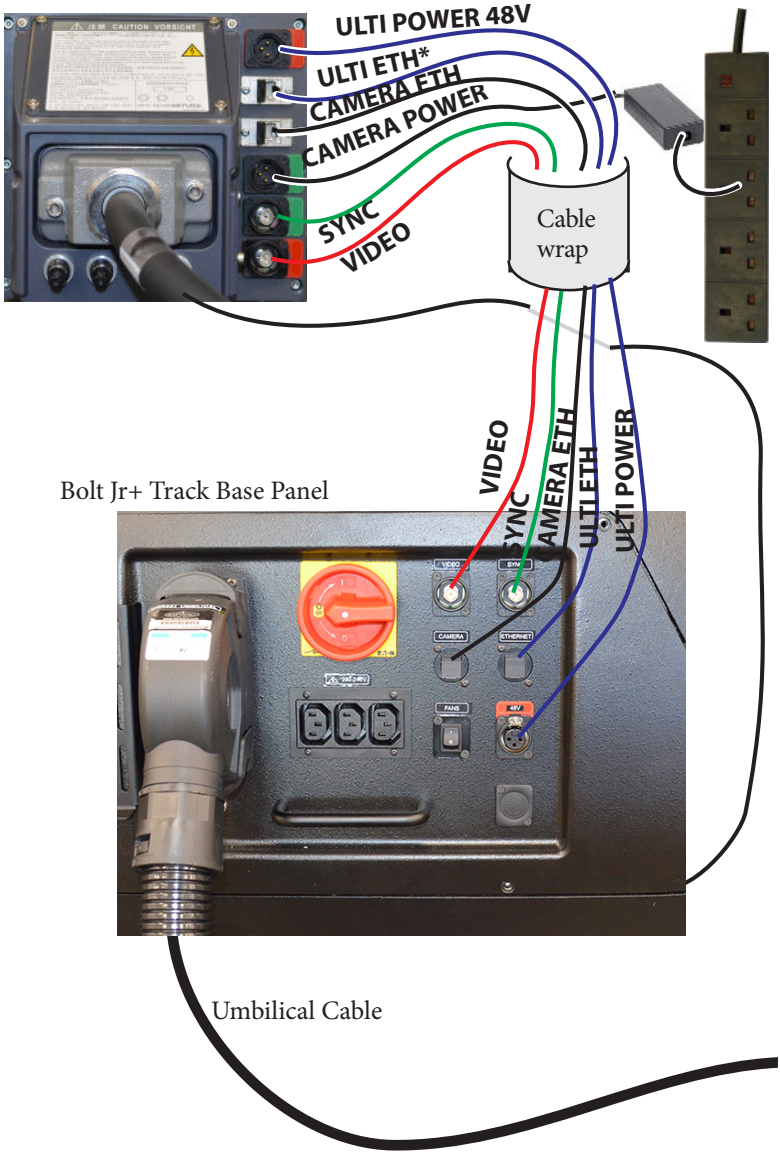
Connecting the cables (Bolt™ Jr+ on Pedestal)

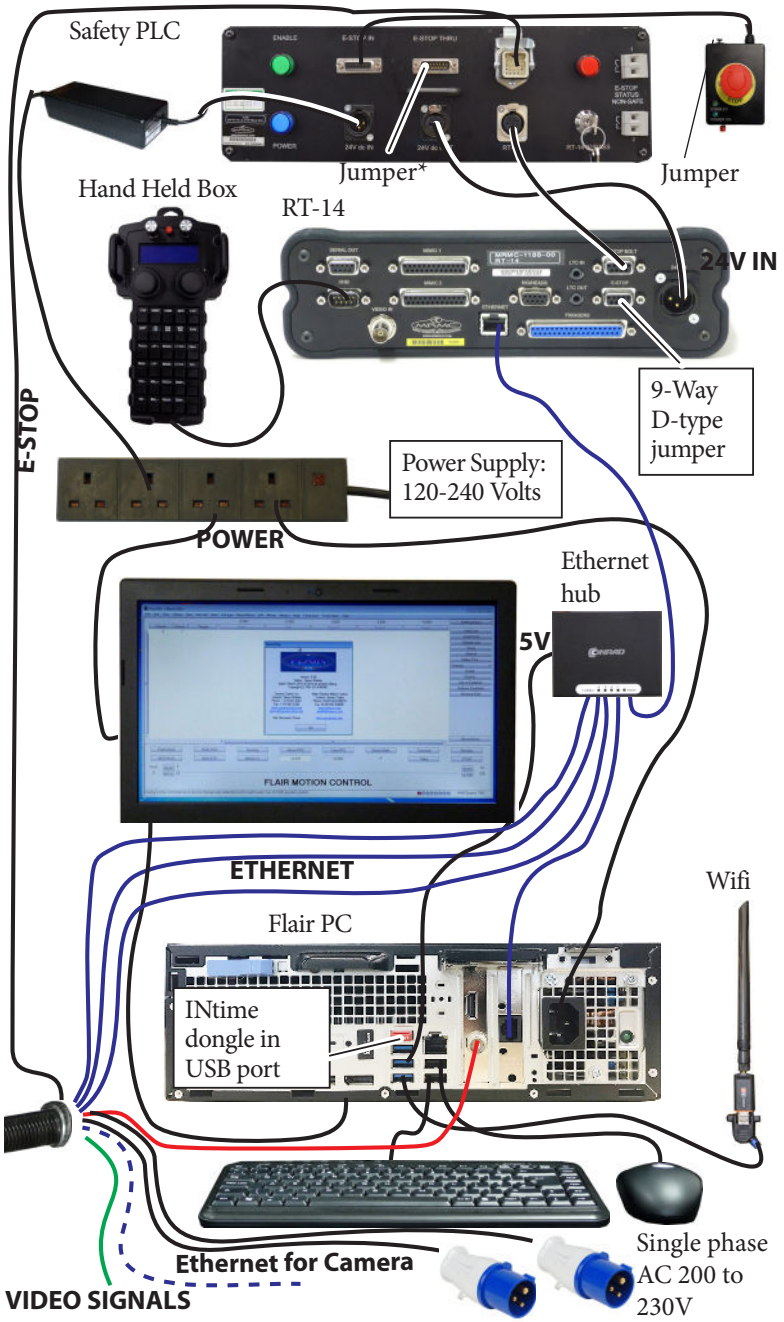




The **Jumper*** only apply when you are using the Model Mover as a single robot system. For more information, refer to Universal E-stop System Quick Start Guide.

Connecting the cables (Bolt Jr+ on Track)




Safety PLC
Jumper*
Jumper
Hand Held Box
RT-14
24V IN
9-Way
D-type
jumper
E-STOP
Power Supply:
120-240 Volts
POWER
Ethernet
hub
5V
FLAIR MOTION CONTROL
ETHERNET
Wifi
Flair PC
INtime
dongle in
USB port
Ethernet for Camera
VIDEO SIGNALS
Single phase
AC 200 to
230V

Important

The Jumper* in the Safety PLC applies when using this robot as a single robot operation. For more information on using the Universal Robot system with multiple robots, refer to the Universal E-stop System Quick Start Guide.

The desk top E-stop box can also be daisy-chained to multiple E-stop buttons. For more information, refer to Universal E-stop System Quick Start Guide.

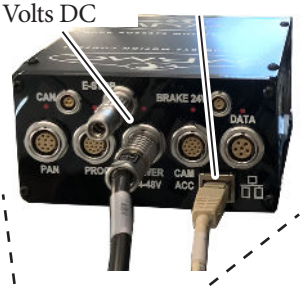
Bolt Jr+ arm connectors for Ulti-box and camera

The connections that go through the Bolt Jr+ arm are shown below. These are for the Ulti-box mounted on the arm, and for the camera that you mount in the cage at the end of the arm.

POWER input: 24-48 Volts DC

ETHERNET for Ulti box

Ulti-box, which provides various connectors for camera and lens controls. For details see *Ulti-box connector summary* on page 43.



POWER output: 48 Volts DC

Video 1

ETHERNET for Ulti

Video 2

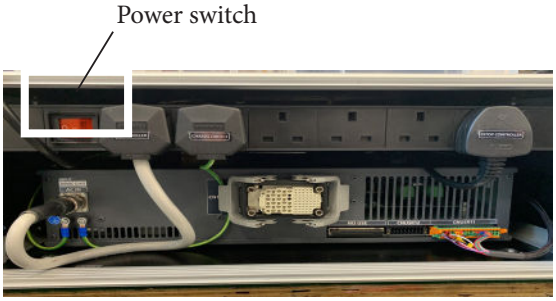
ETHERNET for camera

Starting up the Bolt™ Jr+ on Pedestal 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 Jr+. Put up guard rails around Bolt Jr+ (and the track) 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 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)

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).

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:

   - The Ulti-box that is mounted on the Bolt Jr+ arm
   - Any additional 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**

5. 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. In Flair, click on the **Engage Robot** button.
7. Zero the axes as required in Flair. The Bolt Jr+ 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.
8. In Flair, move the Bolt Jr+ arm to its home position (rotated straight forward and tucked under).
9. Set the soft limits for the rig axes in Flair as required:
    - Lens Control Motor limits (if using external LCMs)
    - 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.

Bolt™ Jr+ start-up summary

1. Secure the area
2. Switch on Bolt Jr+
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. Zero the track and Lens Control Motor axes
9. Home the arm, carefully
10. Set the soft limits

The rig is now ready to use.

Starting up the Bolt™ Jr+ on Track 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 Jr+. Put up guard rails around Bolt Jr+ (and the track) as necessary, and tell others on the set that you are now powering up the rig.

2. Release the E-stop on the **Bolt Jr+ Base** by turning the red button clockwise until the button pops up. **Do not release the other E-stop by the computer stack yet.**

3. Power up Bolt Jr+ itself as follows:

Turn on the power switch on the side of the Bolt Jr+ Base.

For more details on the LEDs during power up on CR800 controller that is housed inside the base, refer to page 30.

4. 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).

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:

   - The Quad Board that runs the track motor
   - The Ulti-box that is mounted on the Bolt Jr+ arm
   - Any additional interface boxes that are attached to the computer stack and any model movers

6. 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

7. Zero the axes as required in Flair. The Bolt Jr+ arm itself does not require zeroing but you need to zero other axes such as:

   - The Track: To do this you use the **Zero > Home Axis > Track** menu option.
   - 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 movers

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

> Hint
>
> You use the **Track** button in Flair to toggle the track on and off, independently of the **Engage Robot/Disengage Robot** button that you use to toggle the Bolt Jr+ arm on and off.

9. In Flair, move the Bolt Jr+ arm to its home position (rotated straight forward and tucked under).
10. Set the soft limits for the rig axes in Flair as required:
    - Track limits
    - Lens Control Motor limits (if using external LCMs)

Bolt™ Jr+ start-up summary

1. Secure the area
2. Release the E-stop on the rig
3. Switch on Bolt Jr+
4. Switch on the Flair PC
5. Start Flair
6. Release the E-stop on the computer stack

In Flair:

7. Zero the track and Lens Control Motor axes
8. **Engage Robot**
9. Home the arm, carefully
10. Set the soft limits

The rig is now ready to use.

Shutting down the Bolt™ Jr+ system

1. Move Bolt Jr+ to its Home position, for both the arm and the track.

   or...

   If you are going to transport Bolt Jr+ to a new location, put the Bolt Jr+ 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. In the Flair software, disengage the track by toggling off the **Track** button.
4. Press down all E-stop buttons:
   - On the computer stack
   - On the **Bolt Jr+ Base**
5. Close the Flair software.
6. Shut down Windows on the Flair PC.
7. Turn off Bolt Jr+ as follows:

   Turn off the power switch on the side of the Bolt Jr+ Base.

Note

To remove Bolt Jr+ from the track see *Mounting Bolt (family of robots) on the track* in the separate *Precision Track Quick Start Guide* and follow the instructions there in reverse order, to attach the trolley wheels, detach the pinch motor wheels and remove the rig from the track bearings.

Bolt™ Jr+ shut-down summary

1. Move Bolt Jr+ to the Home or Transport position
2. In Flair: **Disengage Robot**
3. In Flair: Toggle off the **Track**
4. Press down all E-stops
5. Close Flair
6. Shut down Windows
7. Switch off Bolt Jr+

Bolt Jr+ on Track Transport position:

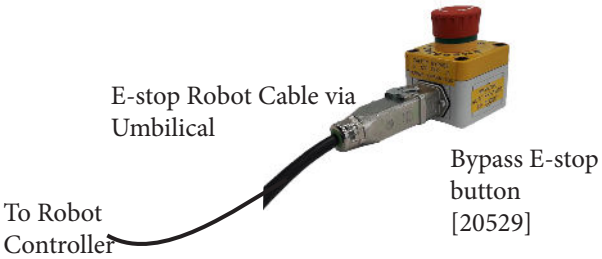
- Arm rotated forward and tucked under.
- Arm about 45 degrees to base slope, above the wheel unit, with about 3cm clearance between it and the base.

Bolt Jr+ on Pedestal 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.

Universal E-stop Bypass Operation

You can bypass the Universal E-stop system temporarily for troubleshooting a fault in the system. To do so, connect the Bypass E-stop button via E-stop Robot Cable in the umbilical to the Robot Controller.

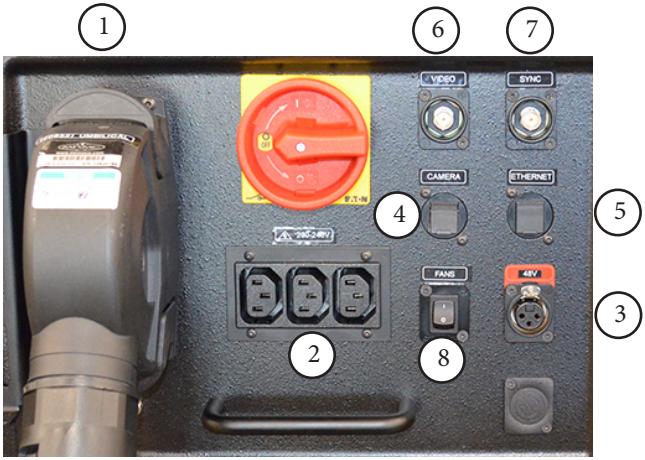


Bypassing the Universal E-stop System is for temporary use only. Robot will enable as soon as E-stop button is reset. This will also bypass the software E-stop and any other hardware E-stops and the robot will have no controlled E-stop action.

Notes

Appendix 1 **Bolt™ Jr+ panels**

Bolt™ Jr+ Track Base panel connector summary

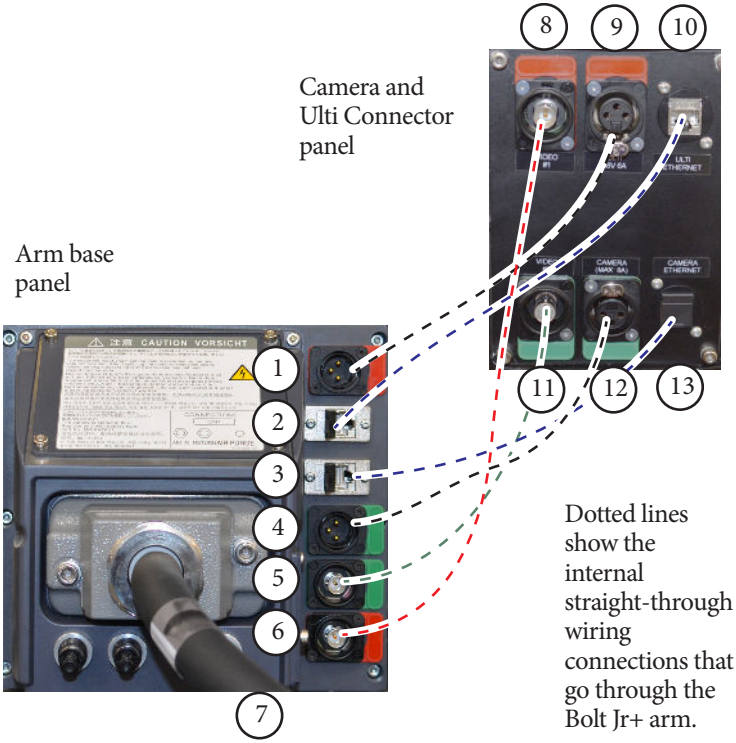


1. **UMBILICAL IN** connector is the main connector that provides 240V single phase power for the controller unit, robot arm and other units on the arm such as Ulti-box and camera. It also includes other connectors for E-stop, video out, sync out, Ulti power and Ulti Ethernet.
2. **240V AC** output (x3), for general use by additional devices, such as camera PSUs, that you want to mount on the rig. For pin-out information, refer to *Mains Out connector* on page 41.
3. **48V OUT** power connector. You usually use this to power the Ulti-box (and its attachments) on the Bolt Jr+ arm. For pin-out information, refer to *Mains Out connector* on page 41.
4. **ETHERNET** connector to connect to the Ethernet connector on the base of the arm to service the camera mounted on the arm.
5. **ETHERNET** connector to connect to the Ethernet connector on the base of the arm to service the Ulti-box mounted on the arm.
6. **VIDEO** connector for the video signal from the camera. For pin-out information, refer to *Video/Sync connector* on page 41.

7. **SYNC** connector for the sync signal from the camera. For pin-out information, refer to *Video/Sync connector* on page 41.

8. **FANS** switch. For switching the fans on/off.

Bolt Jr+ arm panels connector summary



1, 9. **ULTI POWER** input power connector supplies 48 Volts DC output to the Ulti box on the Bolt Jr+ arm. This has a straight-through internal connection to the **Ulti 48V 6A** connector (9) at the far end of the arm. For pin-out information, refer to *Power 48V 6A connector* on page 42.

2, 10. **ULTI ETHERNET** connector is an Ethernet connector or communications between the Ulti box on the robot arm and the rest of the system. The connection between connectors 3 and 10 is a straight-through internal connection through arm, and you ordinarily attach connector 2 to the Ethernet hub that services the

Ulti-box (for Bolt On Pedestal) or to one of the Ethernet connectors in Bolt Jr+ base (for Bolt Jr+ On Track).

3, 13. **CAMERA** connector is an Ethernet 10GB connector for communications between the camera and the rest of the system. The connection between this and the **CAMERA ETHERNET** connector is a straight-through internal connection through arm.

4, 12. **CAMERA POWER** is a 12-24V DC XLR male connector. You can use this to power the camera or other devices mounted on the camera platform. **CAMERA POWER MAX 8A** (Connector 12) on the end of the arm is a straight through connector and supplies the same power as is connected to connector 4. For pin-out information, refer to *Power 12V connector* on page 42.

5, 11. **VIDEO 2** OUT connector for the video/sync signal from/to the camera, if required. This has a straight-through connection to the **VIDEO #2** IN connector (11) at the end of the arm. For pin-out information, refer to *Video/Sync connector* on page 41.

6, 8. **VIDEO 1** OUT connector for the video/sync signal from the camera. This has a straight-through connection to the **VIDEO #1** IN connector (8). You can connect **VIDEO 1** to the **VIDEO** connector on the Bolt Jr+ base using a coaxial cable. For pin-out information, refer to *Video/Sync connector* on page 41.

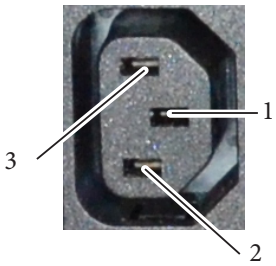
7. **CR800 power and controller** connector. This is for the encoder and power cable that runs between the Bolt Jr+ arm and the CR800 controller unit, which supplies control to the arm.

Connector pin-out information

Mains Out connector

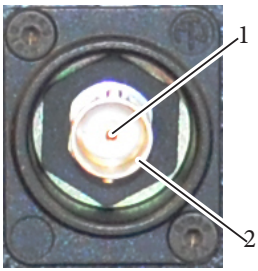
Power output connector for connecting any external devices. It is a 3-Way (Male) C14 IEC connector. 240 Volts AC.

1. Earth
2. Live
3. Neutral



Video/Sync connector

The **VIDEO** and **SYNC** are multi-purpose connectors on the arm and base and connected to each other through the internal wiring, allowing the video signal from the camera to go into the arm, through The arm SYNC connector is connected to the Video#2 connector on top of the arm via internal wiring where it can be connected to the camera. They can be used for synchronization signals between the camera and controller in either direction.

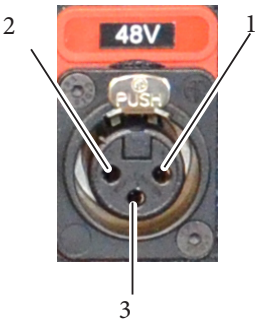


1. VIDEO (inner)
2. GND (outer)

48V Out connector (3-way XLR)

General purpose 48V DC outlet on the base and far end of the Bolt Jr+ arm.

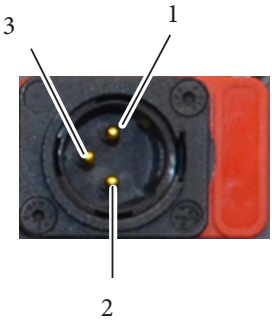
1. GND
2. N/C
3. 48V OUT



Power 48V 6A connector

48V Power input for the Ulti box at the base of the arm.

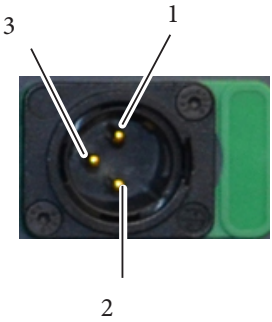
1. GND
2. N/C
3. 48VIN



Power 12V connector

12V (max 8A) Power input (on Arm base) for the camera or any other device mounted on the arm.

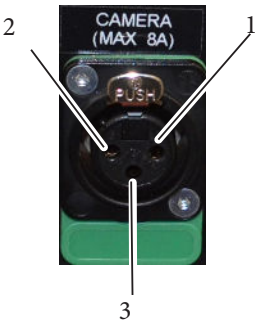
1. GND
2. 12VIN
3. N/C



Camera (Max 8A)

12-24V (max 8A) Power output (on the end of the Arm) for the camera or any other device mounted on the arm.

1. GND
2. 12VOUT
3. N/C



Ulti-box connector summary

The Ulti-box that is mounted on the Bolt Jr+ 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 Bolt Jr+, as Bolt Jr+ 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 46.

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 46.

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 47.

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 47.

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 48.

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. **BRAKE 24V** connector to connect the 24V brake power supply.

8. **E-STOP** connector can be used as an input for E-Stop. To enable the motors, Pins of this connector needs to be shorted, else all drivers are disabled and enable signal from Flair is ignored. It can be connected to the external E-Stop box, but if no external E-Stop is needed, a bypass jumper may be used.

9. **CAN** connector is used to communicate with external CAN capable motor drives.

10,11. **ZOOM**, **FOCUS** connectors for external servo LCMs mounted on the camera platform. For pin-out information see *Servo motor connector* on page 46.

12. **TILT** connector for a Tilt servo motor on a head. For pin-out information see *Servo motor connector* on page 46.

13, 14. **AUX-1**, **AUX-2** connectors for control of auxiliary servo motors. For pin-out information see *Servo motor connector* on page 46.

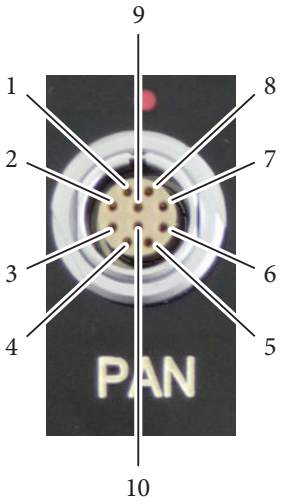
> Note
>
> Connectors 1, 7, 8, 9, 13 and 14 are identical and are labelled only for ease of use.

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.

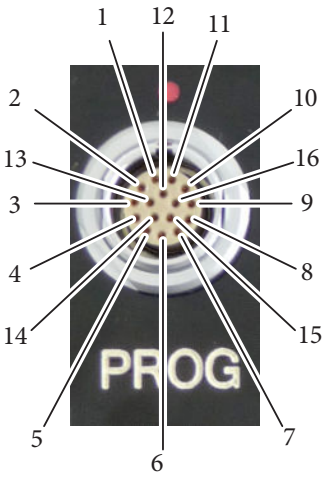
1. DATUM
2. A+
3. B+
4. Z+
5. Brake/Enable output
6. MOTOR_B
7. MOTOR_A
8. LIMIT
9. +5V
10. GND



Program serial connector

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

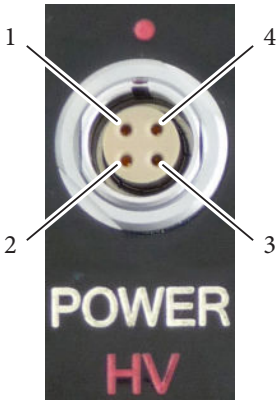
1. SerialTxA
2. SerialRxA
3. +5V
4. FGPIO
5. DSP_TRSTN
6. TCK
7. TMS
8. DSP_TDI
9. DSP_TDO
10. DSP_EMU0
11. DSP_EMU1
12. FPGA_TDI
13. FPGA_TDO
14. BOOT_SEL
15. +3.3V
16. GND



Power connector

The power input connector for the Ulti-box. For usage see page 44.

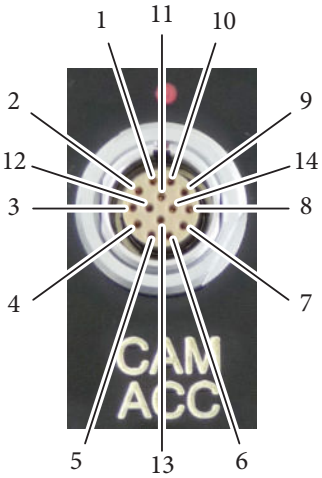
1. GND
2. GND
3. +35V for Basic and +48V for HV
4. +35V for Basic and +48V for HV



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.

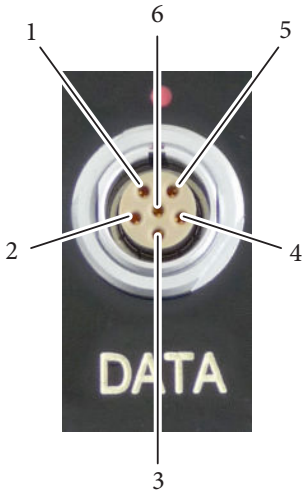
1. Step1
2. Gp2In (Trigger In 2)
3. Step2
4. SerialTxB serial lens control
5. Step3
6. SerialRxB serial lens control
7. Dir3
8. GND
9. +5V
10. Gp1In (Trigger In 1)
11. Dir1
12. Dir2
13. Gp2Out (Trigger Out 2)
14. Gp1Out (Trigger Out 1)



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 44.

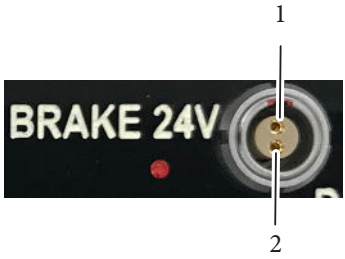
1. Watchdog–
2. Link1Out–
3. Link1Out+
4. Link1In–
5. Link1In+
6. Watchdog+



Brake 24V connector

This is a Lemo Size 0 2-way connector and is sourced from external PSU.

1. GND
2. +24V



E-Stop connector

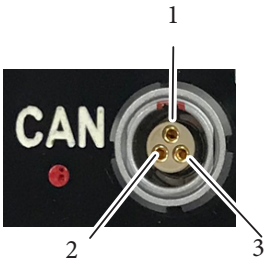
This is a Lemo Size 1 2-way connector; external circuitry should keep the pins closed.

1. E-STOP-
2. E-STOP+

CAN connector

This is a Lemo Size 0 3-way connector; is used to communicate with external CAN capable motor drives.

1. CAN Hi
2. CAN Lo
3. GND



Appendix 2 **Specifications**

Rig Weights

Dimensions	Bolt Jr+ on Track	Bolt Jr+ on Pedestal
Total weight (base+arm+2xcastor wheels	290kg	262kg
Weight- Arm	132kg	132kg
Weight - Base	151kg (including 2 x castor system and power supply unit)	130kg (including 2 x weight plates, 4 x castor wheels, 2 x bridges and 2 x weight buckets)
Weight - anchor weights for track (when track is not bolted to the ground)	4x140kg	-
Weight - Anchor weights for each side of base when base not secured to ground	-	2x140kg (not included in total weight above)
Maximum camera payload	10kg (28.6lbs)	10kg (28.6lbs)

Rig Performance

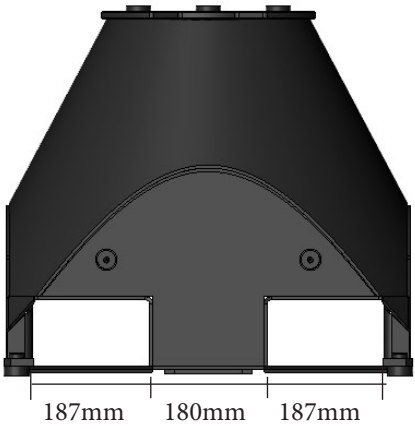
Axis	Travel (degrees)	Max Speed (degrees/s)
Rotate	370(±185)	234
Lift	230 (-55 to +175)	164
Arm	160 (-65 to +95)	219
Pan	390 (±195)	375
Tilt	230 (-205 to +25)	375
Roll	1420(±710)	720
Track	Unlimited	2.9 m/s

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

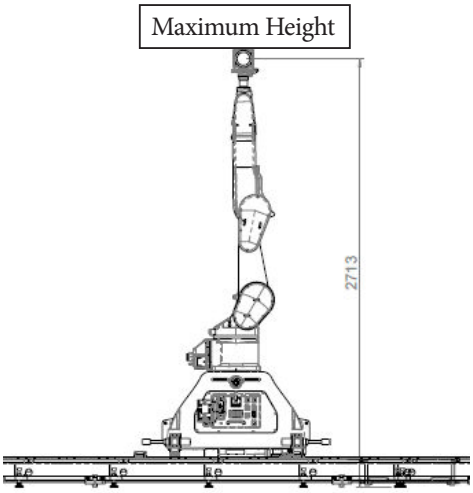
Temperature range: 0-40 °C
Humidity tolerance: 0% to 85% relative humidity, non-condensing

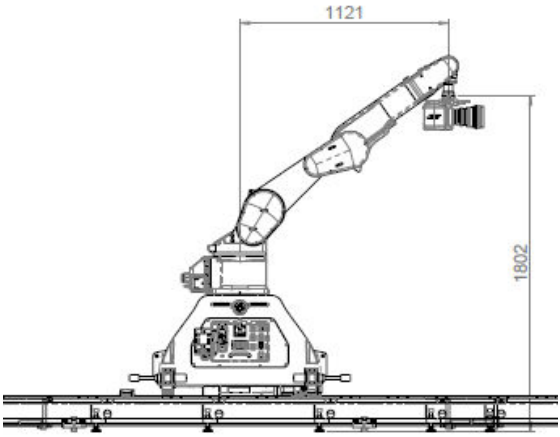
Dimensions

Bolt Jr+ on Pedestal Base Cavities

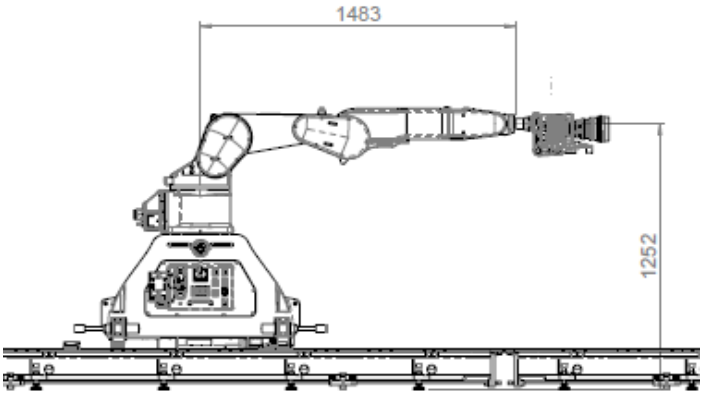


Bolt Jr+ on Track

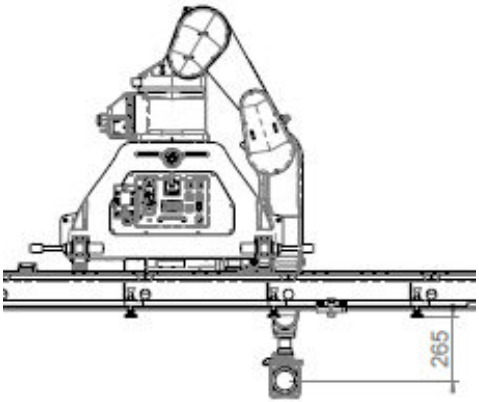




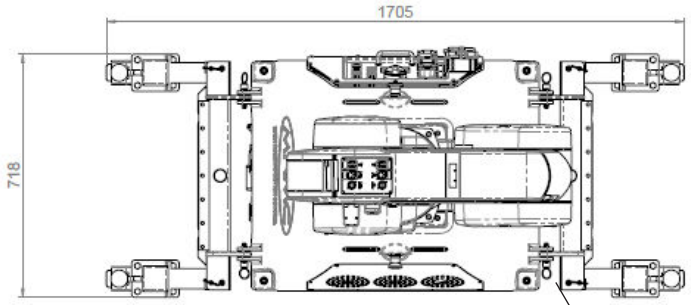
Maximum Reach



Lowest Camera Position

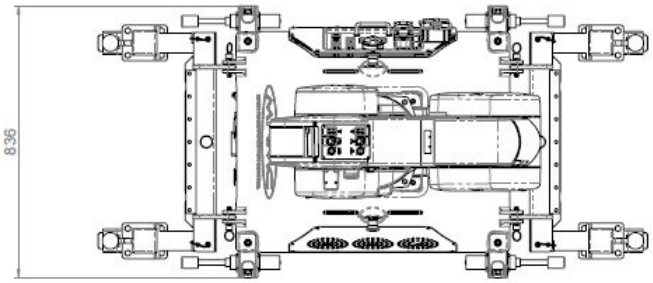


Bolt Jr+ on Track with front wheels in

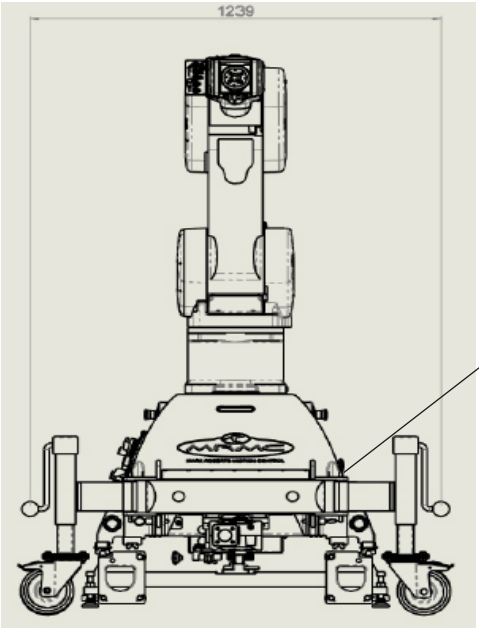


Remove pin to detach and change orientation to wheels out

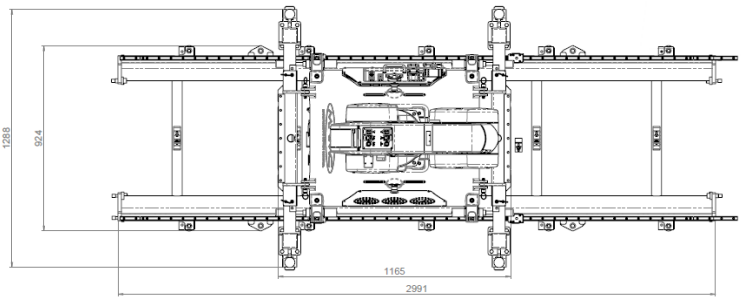
Bolt Jr+ on Track with front wheels in with buffers mounted



Bolt Jr+ on Track with wheels out

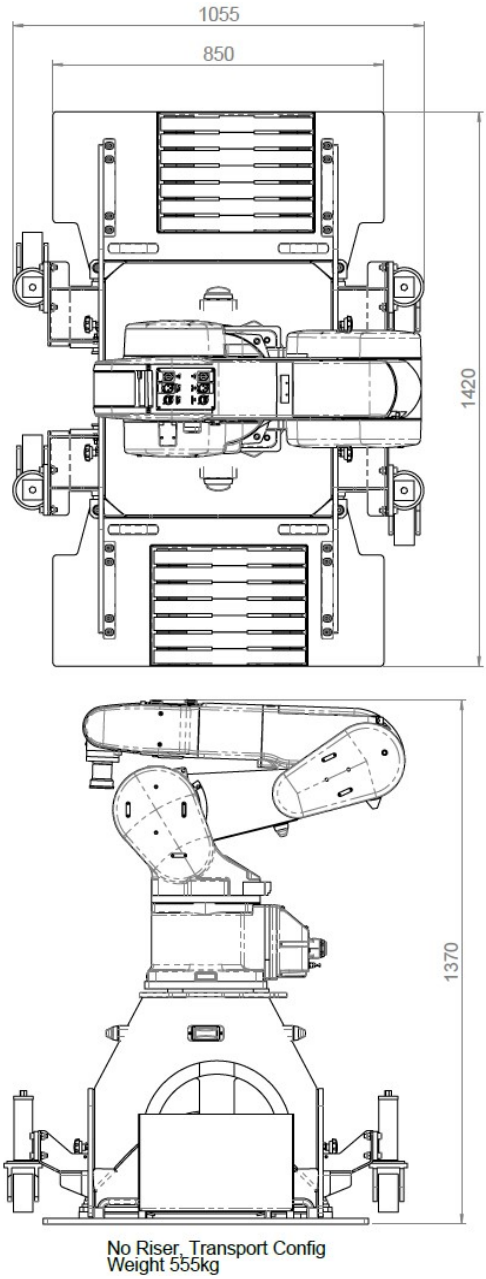


Remove pin to detach and change orientation to wheels in

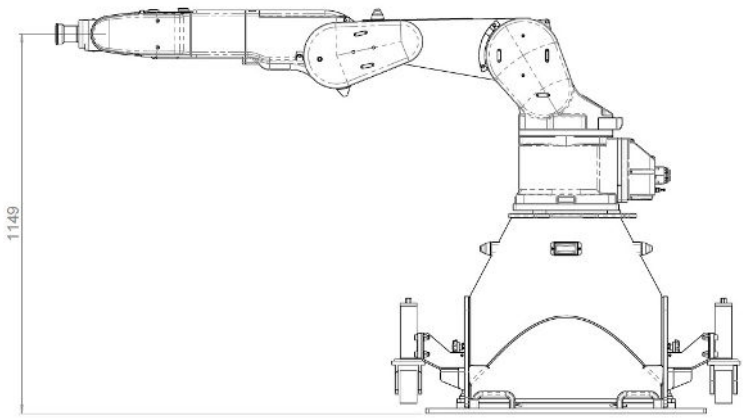


Bolt Jr+ on Track can be wheeled on to the track with wheels out.

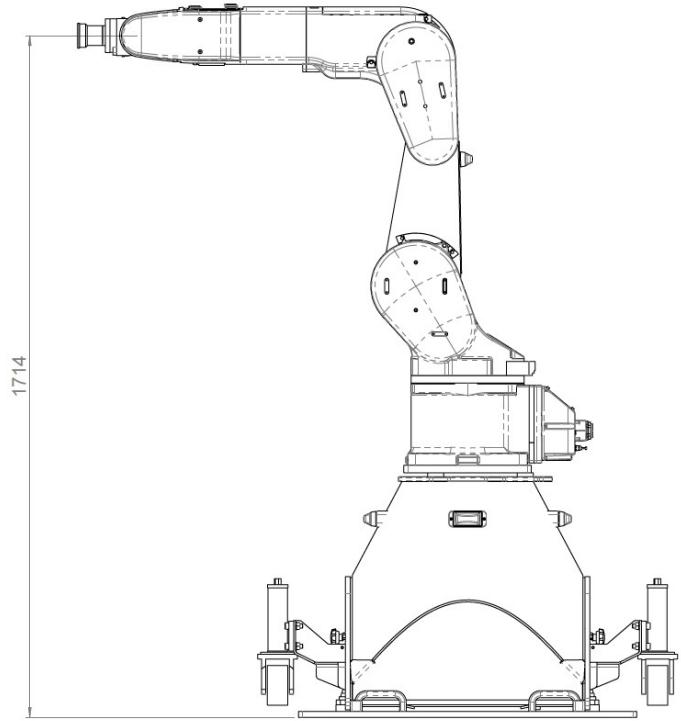
Bolt Jr+ on Pedestal



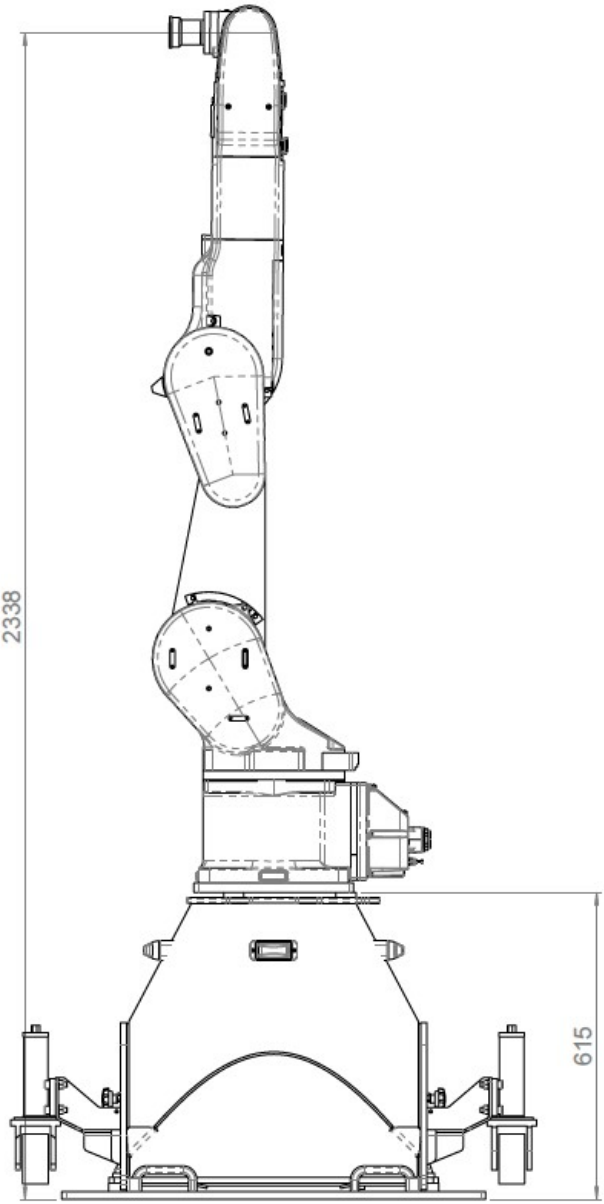
No Riser, Transport Config
Weight 555kg



Arm Horizontal



Arm Square


2338
615

Maximum Power Requirements (USA)

Single Phase

MAX POWER REQUIREMENTS (+/- 10%)	POWER KVA (mean)	SUPPLY VOLTAGE	SUPPLY CURRENT AMPS	SUPPLIED CONNECTOR	TRANS FORMER 120/230	GFI	NOTE
BOLT Jr+ on PEDESTAL (230V)	2	120	20	L14-30P	4KVA	300mA	Note 1
BOLT Jr+ on PEDESTAL (230V)	2	240	10	L14-30P		300mA	
BOLT Jr+ on TRACK (230V)	4	120	10 + 10	2 x L14-30P	4KVA	300mA	
BOLT Jr+ on TRACK (230V)	4	240	10 + 10	L14-30P		300mA	Note 2

Notes:

1. Nominal input voltage of the Mitsubishi arm is 230VAC +/- 10%. The transformer must be designed to provide a nominal 230VAC output, in this case from 120V ± 6% to keep the output within the maximum allowed. Its is more cost effective to supply the 4KVA transformer with the pedestal rig as it is also suitable for a future track upgrade if required.
2. The Bolt Jr+ on Track (arm plus track unit) is delivered with two power cables and is designed to run from two 230VAC 15A supplies only. Both cables must be used. A converging unit with 15A breakers on each cable, that brings the two connectors to a single L14-30P connector, is supplied for convenience.

Maximum Power Requirements (UK/EU)

Single Phase

ASSUMED	VOLTAGE VAC	CURRENT AMPS	POLES	CONNECTOR
SUPPLY (1)	230	30	L+N+E	BLUE 16A 240V
SUPPLY (2)	230	13	L+N+E	TYPE G

MRMC RIGS – MAX POWER REQUIREMENTS (+/-10%)	POWER KVA (peak)	SUPPLY VOLTAGE	SUPPLY CURRENT AMPS	POLES	SUPPLIED CONNECTOR	RCD
BOLT Jr+ on PEDESTAL (230V)	3	230	13	1+N+E	BLUE 16A 240V	300mA
BOLT Jr+ on TRACK (230V)	6	230	13 + 13	1+N+E	2 x BLUE 16A 240V	300mA

Note

The BOLT Jr+ on Track (Arm plus Track unit) is delivered with two power cables and is designed to run from two 230VAC 10A supplies only. Both cables must be used.

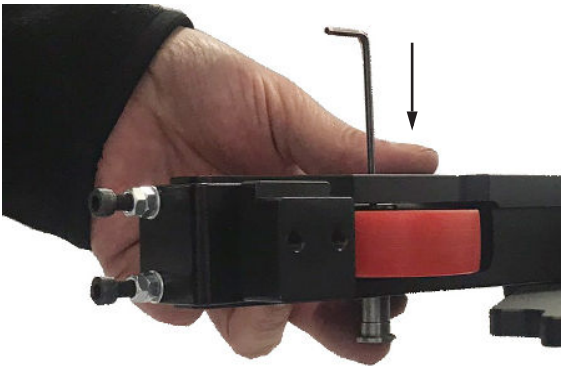
Appendix 3 **Maintenance**

Replacing the Pinch Wheel

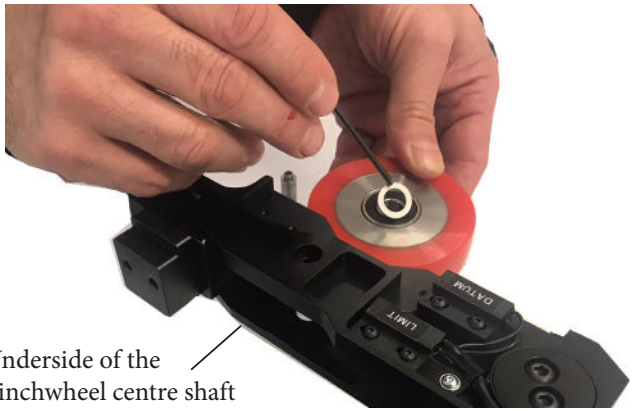
The worn out pinch wheel can be replaced in the pinch wheel assembly using the following procedure:

1. Unscrew the small screw on the pinch wheel on the underside of the pinch wheel assembly. The pinch wheel is not completely detached yet.

2. Using the same allen key push in the screw cavity to release the pin securing the pinch wheel.



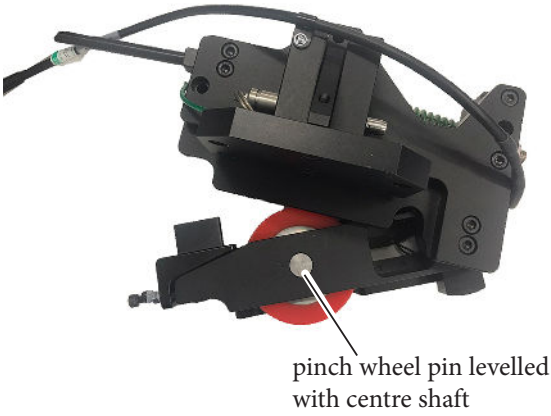
3. Notice a washer above the pinch wheel; keep it aside. Discard the worn out pinch wheel.



4. Replace the washer on the new pinch wheel carefully and inserting it lined with the screw cavities in the centre shaft of the pinch wheel assembly. Ensure that the washer is inserted towards the underside of the shaft and not on the top.

5. When the pinch wheel is centred on the cavities insert the pin. (Refer to step 2 for alignment and pin position). Push the pin enough so it is flush with shaft and is not protruding.

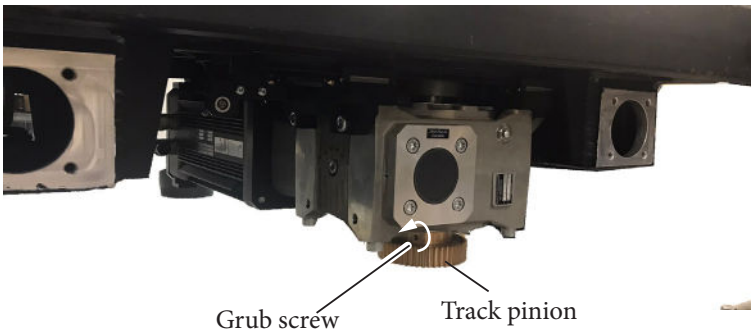
6. Replace the screw and washer to secure the pinch wheel to the assembly.



Replacing Track Pinion

This procedure can be performed either while the robot is on track or while the robot is on jacking wheels.

1. If the robot is mounted on the track, remove the pinchwheel assembly from the track motor and move the track motor away from the rail racking. Using bare fingers, observe the underside of the pinion to perceive the position of the pinion on the shaft.
2. Remove the grub screw from the track pinion.



3. You should now be able to release without applying pressure. If it is not released easily, use Flair to run the track motor at a slow speed,

eg 20rpm. While the track pinion is rotating, use a heat gun to heat the pinion to allow it to expand.

Caution

- Take care when heating the pinion with the heat gun to only direct the gun downwards onto the sides and central when underneath. If the heat gun is directed at the gearbox seal above the pinion it can cause damage and create leaks.
- Do not hit the pinion or gearbox with any tools to detach it from the gearbox. Hammering can cause permanent damage to the pinion and gearbox.

4. Once the pinion is sufficiently expanded, using heat-proof gloves, try removing the pinion; again without using much pressure.
5. Replace the new track pinion by inserting it onto the shaft. If it doesn't fit easily, heat it using the heat gun and then slide it on to the track motor shaft. The position of the pinion should be the same as you had observed before removing the worn out pinion; approximately only 1-2mm of shaft projecting from the pinion centre.
6. Replace the grub screw to secure the pinion.

Replacing the Encoder Batteries

The arm uses encoder batteries to store the position when powered off. These batteries are installed when the robot is shipped from the factory, but should be replaced periodically by the customer. The guideline for

replacing the battery is 1-2 years, but this may differ according to the robot's usage.

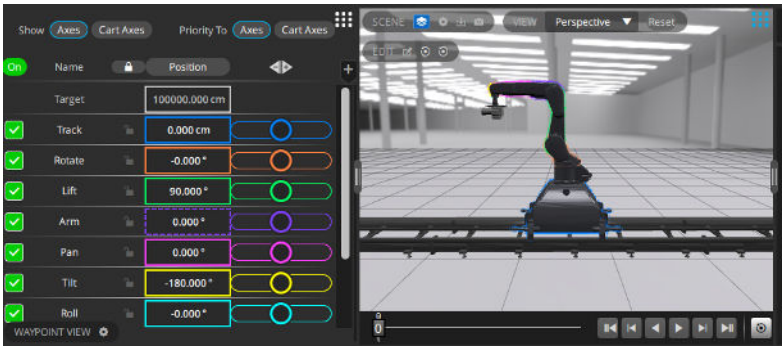
As part of your spares you should have received 1 set of 4 encoder batteries.

Before replacing the batteries, it is important to move the robot into the calibration position.

Calibration Position Flair

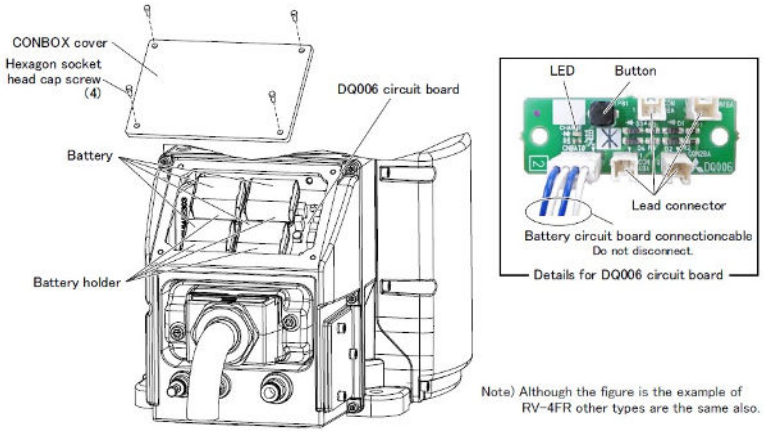
Move the robot in the position as shown below. This is a precaution in case the encoder positions are lost and the robot needs to be manually reconfigured.

If for any reason the origin is lost, contact MRMC for directions on how to re-calibrate it.



You MUST replace the battery one by one. If all batteries are removed the encoder data will be lost, and resetting the origin is necessary.

You MUST replace the whole set of 4 batteries. Do not leave an old battery in place with newer batteries.



1. Turn the controller control power OFF.
2. Remove the CONBOX cover.
3. Check that the capacitor is fully charged. Press the button on the DQ006 circuit board and check that the LED on the same circuit board turns on.
4. Replace the battery within 15 minutes after checking that the LED turns on.
5. If the LED does not turn on when the button is pressed, the capacitor needs to be charged. Turn on the controller and charge the capacitor for approximately 30 minutes.
6. Replaces the backup battery one by one. The battery holder is located inside the CONBOX cover. Remove the old battery from the holder, and disconnect the lead connector.
7. Insert the new battery into the holder, and connect the lead connector. Replace all batteries with new ones at the same time.
8. Ensure that all batteries have been replaced. If the old battery is contained, generating heat and damaging may occur.
9. Install the CONBOX cover as before. Ensure that any cable is not caught.

If the old battery is replaced because it has been used up, it is necessary to set the origin again.

Re-homing the Arm after Changing Batteries

In the case of lost encoder positions, the most accurate way to reset the origin is to re-use the encoder data origin file. Contact MRMC to request for the encoder origin file for the robot. The file would simply need to be loaded to the controller, using the 'origin data input' menu on RT Toolbox.

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