BOLT JUNIOR
COMPACT LIGHTWEIGHT HIGH SPEED ROBOT

QUICK START GUIDE

Product Code: MRMC-1558-00, MRMC-2000-00
Part number: MRMC-1567-01
Bolt Junior Quick Start Guide

Product Code: MRMC-1558-00, MRMC-2000-00
Part number: MRMC-1567-01

© 2018 Mark Roberts Motion Control Ltd. All rights reserved.

No part of this publication may be reproduced, transmitted, or translated by any means — graphical, electronic, or mechanical — including photocopying, recording, taping, or storage in an information retrieval system, without the express written permission of Mark Roberts Motion Control.

Although every care has been taken to ensure that the information in this document is accurate and up to date, Mark Roberts Motion Control continuously strives to improve their products and may make changes to the hardware, firmware, and software described in this document. Mark Roberts Motion Control therefore cannot be held responsible for any error or omission in this document.

All product names mentioned herein are the trademarks or registered trademarks of their respective owners.

<table>
<thead>
<tr>
<th>Contact information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mark Roberts Motion Control Ltd.</strong></td>
</tr>
<tr>
<td>Unit 3, South East Studios</td>
</tr>
<tr>
<td>Blindley Heath</td>
</tr>
<tr>
<td>Surrey</td>
</tr>
<tr>
<td>RH7 6JP</td>
</tr>
<tr>
<td>United Kingdom</td>
</tr>
<tr>
<td>Telephone: +44 (0) 1342 838000</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:info@mrmoco.com">info@mrmoco.com</a> (sales and general enquiries) <a href="mailto:support@mrmoco.com">support@mrmoco.com</a> (customer support)</td>
</tr>
<tr>
<td>Web: <a href="http://www.mrmoco.com">www.mrmoco.com</a> <a href="http://www.mrmocorentals.com">www.mrmocorentals.com</a></td>
</tr>
</tbody>
</table>
Contents

Chapter 1  Quick Start................................................................. 1

  Overview ............................................................................. 1
  Safety procedures for using industrial robots, including high speed track ..................................................... 2
    Assessing a site ....................................................................... 3
    Installation safety ................................................................... 3
    Software setup ......................................................................... 6
    Operational safety ..................................................................... 6
  Mounting the Castor Wheels .................................................... 7
  Mounting the Weight Plates (Bolt Junior on Pedestal) .......................................................... 10
  Mounting the Riser .................................................................... 11
  Anchoring Bolt Junior on Pedestal to the floor ....................... 11
  Mounting the Staubli Arm .......................................................... 14
  Connecting the cables ................................................................ 16
  Bolt Junior arm connectors for Ulti-box and camera ............ 19
  Starting up the Bolt Junior system ......................................... 20
    Bolt Junior start-up summary ................................................. 24
  Shutting down the Bolt Junior system ................................. 25
    Bolt Junior shut-down summary ........................................... 26
  Moving the Bolt Junior arm by hand ...................................... 26

Appendix 1  Troubleshooting.............................................................. 30

  Typical symptoms, causes, and actions ................................... 30

Appendix 2  Bolt Junior panels .......................................................... 32

  Bolt Junior Track Base panel connector summary ............... 32
  Bolt Junior arm panels connector summary ....................... 34
  Ulti-box connector summary ................................................ 36
  Ulti-box connector pin-out information ............................... 38
    Servo motor connector ......................................................... 38
    Program serial connector .................................................... 38
    Power connector .................................................................. 39
    Camera Accessory connector ............................................. 39
    Data In connector .................................................................. 40
Appendix 3 Specifications

- Rig Weights
- Rig Performance
- Operating Envelope
Chapter 1  Quick Start

Overview

Thank you for using the Bolt Junior Cinebot from Mark Roberts Motion Control (MRMC). Bolt Junior 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. It 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.
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 Junior.

- Unlike traditional motion control equipment, Bolt Junior 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 Junior 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 Junior 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 Junior 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 Junior itself (294 kg) plus the weight of the track (95 kg per section).

- Does the site have access? You need to make sure you can either push Bolt Junior 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 Junior on Track requires a **240 Volts, single-phase power supply via 2x16amps power connectors**.
  - Bolt Junior on Pedestal requires a **240 Volts, single-phase power supply via a 16amps power connector**.
  - The computer stack that controls Bolt Junior (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 100kg of counter weights on each corner of the track.

  ⇔ 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 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 Castor Wheels

If the castor wheels are not mounted, use the following procedure to mount the castor wheels:

1. Gently tip the base over from the top so its bottom is visible.
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.
3. Similarly insert all the castors into the base ensuring the plates are inserted into the slots.

4. Stand the base on the wheels and tighten the four screws to secure the castor wheels on the base. Do not use the jack screws on the wheels yet to seat them on the ground.
Mounting the Weight Plates (Bolt Junior 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 Junior 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. Secure the weight plates using the 2XM10 screws on either plate.

4. Lower the base completely so it is resting on both wings. At this point, you can remove the castor wheels, if so desired.

5. Put the weights onto the wings. Bolt Junior requires four boxes of weights — one at each corner. Each box contains 140 Kg of weights (7 × 20 Kg).

Hint

You can move Bolt Junior without removing the wings if you want, as long as you take the weights off first.
Mounting the Riser

Use the following instructions to mount any riser or an additional riser on the pedestal:

1. Lower the riser on the base aligning the three screw cavities.
2. Tighten the three screws.

Anchoring Bolt Junior on Pedestal to the floor

If you are setting up Bolt Junior on Pedestal in a permanent (or semi-permanent) location, you can anchor the pedestal to the floor as an

Note

If you are using the 300mm riser, anchor the Bolt Junior 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.
alternative to holding it down with weights. The following procedure tells you how to anchor the pedestal to a concrete floor.

1. Temporarily put the Bolt Junior on Pedestal into place where you want.

2. At one corner of the pedestal, use one of the two holes 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 Junior on Pedestal and at one of the four circles that you have drawn, draw a cross centred on the circle, to help you precisely locate the drill bit.
   
   Repeat for the other three corners.

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 Junior 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.
Mounting the Staubli Arm

1. Lower the TX90 Staubli arm on the Bolt Junior on Pedestal aligning the sides and screw cavities.
2. Tighten the three screws.
Connecting the cables

*These Ethernet (ETH) ports are for network connection to the track motor controller and to the Ulti-box for LCMs via the Staubli arm. ETHERCAT goes to the Stäubli CS8 in the base only, which controls the arm.
Power Supply: 120-240 Volts

INtime dongle cable in USB port

Ethernet for Camera

VIDEO SIGNALS
Picture of Bolt Junior connections:
Bolt Junior arm connectors for Ulti-box and camera

The connections that go through the Bolt Junior 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

**POWER** output: 24-48 Volts DC

**ETHERNET** for the Ulti-box

**ETHERNET** for the camera

**Video 1**

**Video 2**

**J1202**: Power input and Ethernet for the Ulti-box

**POWER** input for camera: 24-48 Volts DC

Ulti-box, which provides various connectors for camera and lens controls. For details see *Ulti-box connector summary* on page 36.
Starting up the Bolt Junior 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 Junior. Put up guard rails around Bolt Junior (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 Junior Base by turning the red button clockwise until the button pops up. Also make sure the key is in the clockwise position. **Do not release the other E-stop by the computer stack yet.**

3. Power up Bolt Junior itself as follows:
   
   Turn on the power switch on the side of the Bolt Junior Base.

   ![](image)

   The Bolt Junior power-up sequence takes about three minutes.
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 3). **Do not start the Flair application yet.**

5. After the robot has finished powering up (step 3), the cifX board in the Flair PC display two steady lights and one blinking light (see previous diagram).

If the cifX board lights do not show as above after about three minutes, then close Flair and restart INtime as follows:
5.1 In the Windows Taskbar, right-click the INtime icon.

5.2 Select **Restart NodeA**.

6. 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 Junior arm
- Any additional interface boxes that are attached to the computer stack

7. 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 Reset button. Also make sure the key is in the vertical position. The horizontal position of the key bypasses E-stop from Hand Held box and Flair. Therefore, the key should **not** be kept in horizontal position when using Bolt Junior except for testing purposes.

Once all E-stop buttons on the system are up, the Stäubli CS8 display shows “U”.
8. Zero the axes as required in Flair. The Bolt 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** ($\infty$), **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.

9. 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 Junior arm on and off.

10. In Flair, move the Bolt Junior arm to its home position (rotated straight forward and tucked under).

   **Hint**
   
   If the Bolt Junior arm is in a backward or reversed starting position, the arm might swing overhead or around the side to reach the home position, possibly striking the walls, ceiling, or other rigging! If the rig is in an enclosed space or near other equipment, it is recommended that you do the following:
   - Manually move the arm close to its home position before Homing it.
   - When you home the rig, have one hand ready on the E-stop in case you need to stop the rig quickly.

11. Set the soft limits for the rig axes in Flair as required:
   - Arm position limits
   - Track limits
Bolt Junior Quick Start Guide

- Lens Control Motor limits (if using external LCMs)

**Bolt Junior start-up summary**

1. Secure the area
2. Release the E-stop on the rig
3. Switch on Bolt Junior
4. Switch on the Flair PC
5. Check networking lights after three minutes; **Start Robot** if needed
6. Start Flair
7. Release the E-stop on the computer stack
   
   In Flair:
8. Zero the track and Lens Control Motor axes
9. **Engage Robot**
10. Home the arm, carefully
11. Set the soft limits

The rig is now ready to use.
Shutting down the Bolt Junior system

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

   or...

   If you are going to transport Bolt Junior to a new location, put the Bolt Junior arm into its transport position. You can do this either by using Flair (although you might have to reset the soft limits to reach the transport position) or by moving the arm manually. For details see page 26.

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 Junior Base**

5. Close the Flair software.

6. Shut down Windows on the Flair PC.

7. Turn off Bolt Junior as follows:

   Turn off the power switch on the side of the Bolt Junior Base.

To remove Bolt Junior from the track see *Mounting Bolt 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 Junior shut-down summary

1. Move Bolt Junior 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 Junior

Moving the Bolt Junior arm by hand

In some circumstance you need to move the Bolt Junior arm manually with your own hands. For example:

- Recovering from a **software lock-up**. For example if momentum has carried the arm outside the soft limits, the software might refuse to move the arm to get back inside the limits.

- Recovering from a **hardware lock-up**. If momentum or a programming error moves the arm against its internal hard limits or if the camera platform gets stuck against another part of the arm, the motors might not be able to back off from this position without tripping out.

- Putting the arm into **transport position**, to make the Bolt Junior volume as small as possible so it will fit into a truck. You can do this with Flair software (although you will probably need to change the soft limits) but if you forget to do so before shutting down the Flair computer then you can do it by hand.
To move the Bolt Junior arm by hand:

1. Make sure that robot itself has power and is switched on. The brakes are on when the unit is switched off, so if you want to move the arm by hand, Bolt Junior must have power and be switched on.

2. If the robot is connected to a running Flair PC, click on the **Disengage Robot** button in Flair.

**Hint**

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

**Transport position:**

- Arm rotated forward and tucked under.
- Camera platform perpendicular to base slope, above the wheel unit, with about 3 cm clearance between it and the base.
3. Person 1: Use the Brake Release Switch to select which Bolt Junior axis you want to move.

4. Person 2: By hand, securely hold the portion of the arm that you want to move so it does not fall when you release the brake.

5. Person 1: Press and hold the Brake Release button.

6. Person 2: Move the arm by hand.

7. Person 1: Release the Brake Release button.

8. Repeat steps 3 to 7 to move all the axes you want.

9. When you have finished, turn the Brake Release Switch to the ‘0’ position, and power down.
## Troubleshooting

### Typical symptoms, causes, and actions

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Cause and/or action</th>
</tr>
</thead>
</table>
| Flair fails to establish a network connection to the Bolt Junior controller (the Stäubli CS8) over the **ETHERCAT** cable. | Try a different cable. The cable between the cifX boards in the Flair PC and Stäubli CS8 needs to be a high quality, fault-free, straight-through (that is, not cross-over) Ethernet cable.  
Check that all cables are connected correctly and that all devices, including the Ethernet hubs, have power.  
Check the order in which you are powering up the devices (page 20).  
Make sure you have allowed enough time for the Bolt Junior/Stäubli CS8 unit to completely power up (with the cifX board lights displaying the correct pattern) before you double-click on the **Start Robot** icon on the Flair PC Desktop. |
| Bolt Junior won’t move                        | Make sure you have enabled Bolt Junior in Flair (click on the **Engage Robot** button).  
Make sure all of your E-stop buttons are up, and that you have pressed the Reset button on each E-stop (if it has one). When they are all up, the Stäubli CS8 panel displays a “U”.  
If you have moved the Bolt Junior arm by hand with the Brake Release Unit, make sure you have replaced the Brake Release Plug in the socket when you have finished. For details see *Moving the Bolt Junior arm by hand* on page 26. |
Appendix 2  Bolt Junior panels

Bolt Junior Track Base panel connector summary

1. **240V AC** output, for general use by additional devices that you want to mount on the base.

2. **VIDEO 1 IN** input connector for the video 1 signal from the camera. This has a straight-through internal connection to the **VIDEO 1 OUT** connector (8).

3. **VIDEO 2 IN** connector for the video 2 signal from the camera. This has a straight-through connection to the **VIDEO 2 OUT** connector (9).

4. **ETHERNET** (Not used)

5, 10. **ETHERNET** connectors for communications between multiple Ethernet devices on the rig. These two connectors share a common Ethernet hub within the Bolt Junior Base. You ordinarily attach one of these to the computer stack (via the umbilical cable) and one to connector J1202 on the base of the arm to service the Ulti-box mounted on the arm.

6. **48V OUT** power connector. You usually use this to power the Ulti-box (and its attachments) on the Bolt Junior arm, by attaching a cable from this connector to the J1202 connector on the arm.
7. **PENDANT** connector, for attaching a Teach Pendant to the rig. This is required for the rig to operate, and should only be removed under advice from MRMC support staff.

8. **VIDEO 1 OUT** connector for the video 1 signal from the camera. This has a straight-through connection to the **VIDEO 1 IN** connector (2).

9. **VIDEO 2 OUT** connector for the video 2 signal from the camera. This has a straight-through connection to the **VIDEO 2 OUT** connector (3).

11. **ROBOT ONLY** connector. You use this to connect the cifX board in the Stäubli CS8 unit (inside the Bolt Junior Base) to the cifX board in the Flair PC, via the umbilical cable. The cifX Ethernet network is an industrial grade high speed network used to control the Bolt Junior motion, and is completely separate from the Ethernet network that runs the Ulti-box and camera.

12. **E STOP** connector. You connect this to the E-stop button beside the computer stack, via the umbilical cable.
Bolt Junior arm panels connector summary

1. **Ulti-box output** connector. This supplies 48 Volts DC output and Ethernet for the Ulti-box mounted on the arm. This has a straight-through internal connection to the **Ulti-box input** connector (6). This connector uses a special two-into-one cable that attaches to the **ETHERNET** and **POWER** connectors on the Ulti-box that is mounted on the Bolt Junior arm.

2. **VIDEO 1 IN** input connector for the video 1 signal from the camera. This has a straight-through internal connection to the **VIDEO 1 OUT** connector (7).

3. **VIDEO 2 IN** connector for the video 2 signal from the camera. This has a straight-through internal connection to the **VIDEO 2 OUT** connector (8).
4. **24-48 Volts DC output power** connector. You can use this to power the camera or other devices mounted on the camera platform. This has a straight-through internal connection to the **24-48 Volts DC input power** connector (9), so the output voltage is whatever voltage you have put into connector 10.

5, 10. **ETHERNET 10GB** connectors (100 Mbits/sec rating) for communications between the camera and the rest of the system. The connection between these two connectors is a straight-through internal connection through arm, and you ordinarily attach connector 10 to the Ethernet hub that services the Ulti-box for one of the Ethernet connectors in Bolt Junior Base.

6. **Ulti-box input** connector. This accepts 48 Volts DC power and Ethernet for the Ulti-box mounted on the arm. This has a straight-through internal connection to the **Ulti-box output** connector (1). This connector uses a special two-into-one cable that attaches to the **ETHERNET** and **48V OUT** connectors on the Bolt Junior Base.

7. **VIDEO 1 OUT** connector for the video 1 signal from the camera. This has a straight-through internal connection to the **VIDEO 1 IN** connector (2).

8. **VIDEO 2 OUT** connector for the video 2 signal from the camera. This has a straight-through internal connection to the **VIDEO 2 OUT** connector (3).

9. **24-48 Volts DC input power** connector. You can use this to power the camera or other devices mounted on the camera platform. This has a straight-through internal connection to the **24-48 Volts DC output power** connector (4).

11. **Stäubli controller** connector. This is for the main cable that runs between the Bolt Junior arm and the Stäubli CS8 controller unit, which supplies both power and control to the arm. The Stäubli CS8 controller is housed inside the Bolt Junior Base.
Ulti-box connector summary

The Ulti-box that is mounted on the Bolt Junior 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 Junior, as Bolt Junior 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 38.

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 38.
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 High Voltage) uses 24-48 Volts. For pin-out information see *Power connector* on page 39.

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 39.

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 one of the following:
   - 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 40.

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 Lens Control Motors (LCMs) mounted on the camera platform. For pin-out information see *Servo motor connector* on page 38.

9. **TILT** connector for a Tilt servo motor on a head. For pin-out information see *Servo motor connector* on page 38.

10, 11. **AUX-1, AUX-2** connectors for control of auxiliary servo motors. For pin-out information see *Servo motor connector* on page 38.
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 37.

1. GND
2. GND
3. +35V
4. +35V

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. SerialRx B 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 37.

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

Rig Weights

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Bolt Junior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight excluding Base</td>
<td>114kg</td>
</tr>
<tr>
<td>Weight - Base</td>
<td>180kg</td>
</tr>
<tr>
<td>Power Supply Unit</td>
<td>50kg (110.2lbs)</td>
</tr>
<tr>
<td>Weight - anchor weights for track</td>
<td>100kg on each corner</td>
</tr>
<tr>
<td>(when track is not bolted to the</td>
<td></td>
</tr>
<tr>
<td>ground)</td>
<td></td>
</tr>
<tr>
<td>Maximum camera payload</td>
<td>10kg (22lbs)</td>
</tr>
</tbody>
</table>

Rig Performance

<table>
<thead>
<tr>
<th>Axis</th>
<th>Travel</th>
<th>Max Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotate (Axis 1)</td>
<td>±180°</td>
<td>400°/ Second</td>
</tr>
<tr>
<td>Lift (Axis 2)</td>
<td>+147.5° / -130°</td>
<td>390°/ Second</td>
</tr>
<tr>
<td>Arm (Axis 3)</td>
<td>±145°</td>
<td>400°/ Second</td>
</tr>
<tr>
<td>Pan (Axis 4)</td>
<td>±270°</td>
<td>540°/ Second</td>
</tr>
<tr>
<td>Tilt (Axis 5)</td>
<td>+140° / -115°</td>
<td>475°/ Second</td>
</tr>
<tr>
<td>Roll (Axis 6)</td>
<td>±270°</td>
<td>260°/ Second</td>
</tr>
<tr>
<td>Track (Axis 7)</td>
<td>Unlimited</td>
<td>2.9 m/ Second</td>
</tr>
</tbody>
</table>

Operating Envelope

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Height (From Ground)</td>
<td>2.2M / 7’ 26”</td>
</tr>
<tr>
<td>Lowest Position</td>
<td>0M / 0’</td>
</tr>
<tr>
<td>Maximum reach (from rotate centre)</td>
<td>1.2M / 3’11”</td>
</tr>
</tbody>
</table>

Temperature range: 0-45 °C (32-113 °F)
Humidity tolerance: 0% to 85% relative humidity, non-condensing

**Bolt Junior on Track power requirements:** 230 Volts, 2x16 Amps, 50-60 Hz with Earth (Ground) connection.

**Bolt Junior on Pedestal power requirements:** 230 Volts, 16 Amps, 50-60 Hz with Earth (Ground) connection.
The Bolt Junior On Track requires single phase 230VAC, 50/60Hz plus Neutral plus Earth to run at maximum speed. The maximum peak current consumption at 230VAC of the Bolt Junior On Track system is calculated to be 26 Amps (20A for the Track Unit and 6A for the Robot). This is the absolute theoretical maximum peak current with the track and all axis of the robot at max acceleration and would occur over a period no more than 2 seconds!

In industrial situations, where we are running large machinery, the breaker must be at least 100ma earth leakage, and preferably 300 ma. Otherwise the machine will not power up and will frequently trip the wall breaker whilst running, and you will not be able to shoot. If you have just fuses instead of a breaker, this will not be a problem.

Bolt Junior On Pedestal can be configured to run on less, with a proportionate drop in performance.
Transformer requirement: Two 3kW, 110-230V step-up transformers.

Optional power generator requirements: 6 kVA