



MARK ROBERTS MOTION CONTROL

# PRECISION TRACK

TRACK FOR LARGE MOTION CONTROL RIGS



## QUICK START GUIDE

Product code: MRMC-1182-06

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## Chapter 1 Assembling the track

### Safety

- Due to the size and weight of track sections, it is recommended that you use at least **two** people to assemble it.



- Motion control rigs have powerful motors that can injure, so take care not to get near the rig while it is switched on.
- Do not step over the track when the rig is switched on — walk around it instead.

### Overview

Thank you for using Precision Track from Mark Roberts Motion Control (MRMC). The track is designed to help you achieve pixel-perfect repeatability of your camera moves by supplying smooth, rigid support when using large, heavy motion control robots such as the Milo, Titan, and Bolt over long distances.

### Before you start

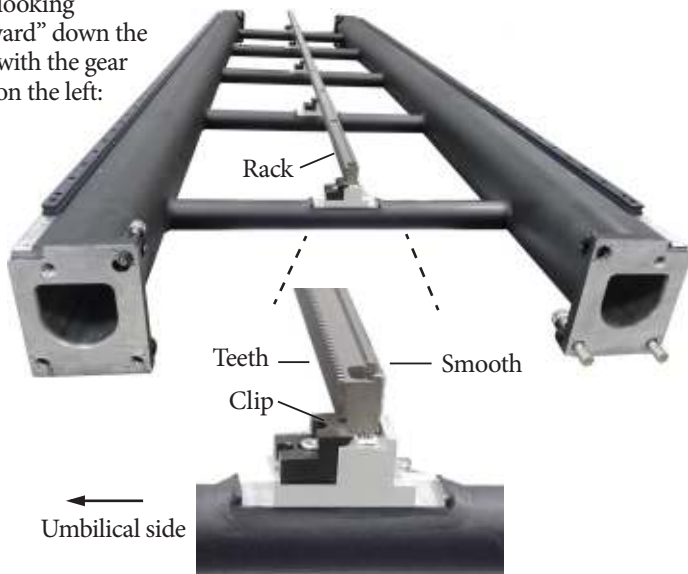
When deciding on the location and orientation of the track, keep in mind the following important points:

- Before laying the track, **assess the site** to see how level and firm the ground or floor is. You might need to use boards, bricks, or crates to create a level surface or stop the track feet sinking into soft ground. If you will be laying more than two track sections on a reasonably level floor, laying the middle section first and working outward can help prevent any unevenness of the floor from accumulating from section to section, beyond the ability of the track height adjustment range

to cope. Beyond this range you will need to use additional supports to keep the track flat and level.

- The track is **not reversible** due to the rack, which has teeth on one side. You must lay all sections the same way around. If your track does not have the rack installed yet, look at the rack clips on the track, which will grip the rail on the teeth side when you install the rail later.

View looking  
“Forward” down the  
track with the gear  
teeth on the left:



- Some rigs have a sense of **Forward** and **Reverse** on the track. A Bolt High-Speed Cine-bot, for example, executes moves going Forward. Because its track motor gear is on the front left underside of the rig, the teeth of the rack are on the left side as you look in the Forward direction down the track.
- Keep in mind where the **umbilical cable** comes out on the rig (if this is important for your shot) and whether you can change it by re-routing the cables on the rig. For example the umbilical cable on Bolt comes out on the same side of the track as the track motor gear (which is the same side as the rack teeth).

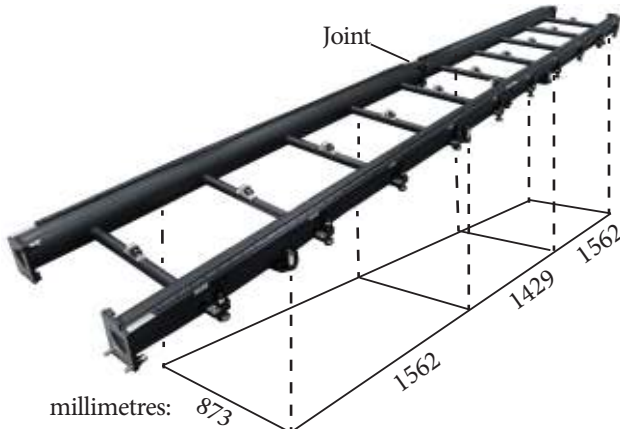
- Each Precision track section has ten **feet** for supporting and levelling the track, and four **anchor brackets** for holding the track down if you are using a high-speed rig such as Bolt.



Foot, which takes the weight of the track and rig

Anchor bracket, which holds the track down on the ground.

- If you are using a fast rig such as Bolt On Track then you must **hold the track down**. You can either anchor the track to the floor to get the best repeatable stability (page 7), or if this is not feasible you can use weights on the ends of the track to give you the safety margin that you need to perform the shoot (page 42). Anchoring the track to a concrete floor involves drilling holes in the floor. If the floor is wood you can screw directly into it. The anchor hole spacing is shown below but it is more accurate to drill through the anchor brackets once the track is in place using the procedures later in this guide.



- If you are using a fast rig with a long arm such as Bolt X on Track and anchoring the track to the floor is not feasible then it should be mounted using weight plates.



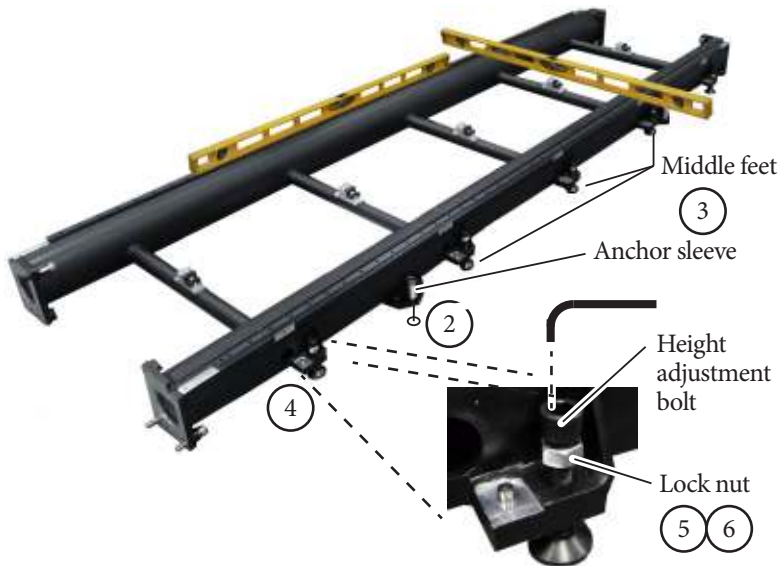


## Laying the first track section

Note

This procedure applies to laying first track section for all large rigs except Bolt X on Track. For laying precision track for Bolt X on Track, use the procedure on *Laying the First Track Section – Bolt X on Track (with Weight Plates)* on page 12.

1. Lay the first track section on the ground, on its feet.
2. If you will be using a fast rig such as Bolt and the floor already has anchor holes from a previous installation then you would obviously put the track anchor brackets over the existing holes.
3. Raise the six middle feet of the track section (three on each rail) and the four threaded anchor sleeves so they do not touch the ground, leaving the rail to rest on the four corner feet.



4. Level the track in both length and width directions using a spirit level, by adjusting the four corner feet of the track. Make sure all four corner feet are touching the ground (no wobble).

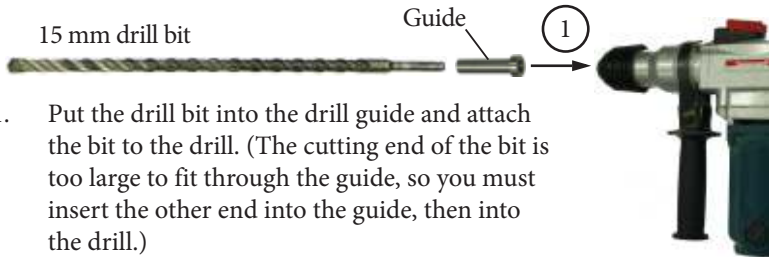
Hint

The four corner feet also determine the track height. If you are laying track on a level floor, try to use the middle of the height adjustment range so that subsequent sections have some leeway (in their feet) to cater for any unevenness in the floor.

5. Tighten the lock nuts down against the track on the corner feet, being careful not to change the height.
6. Lower the six middle feet until they touch the ground (finger tight against the ground) and then tighten the lock nuts on them.

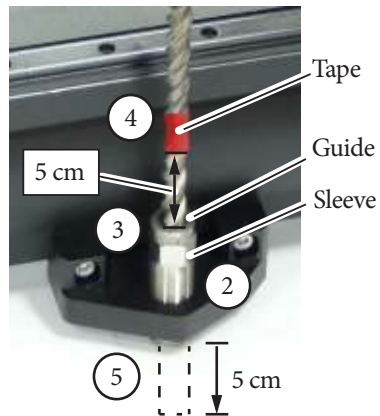
## Anchoring the track

If you are using a fast rig such as Bolt On Track you must either hold the track down with weights (see page 42) or secure the track to the floor by using bolts or screws through the four track anchor brackets. Anchoring the track to the floor gives you more repeatable stability than using weights. The following procedure tells you how to anchor the track to a concrete floor.



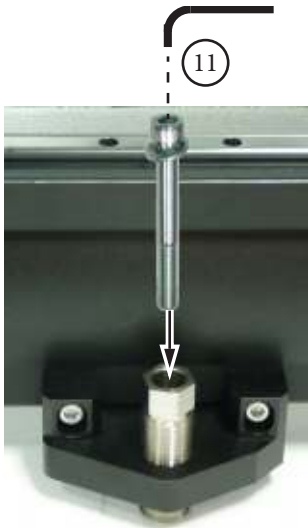
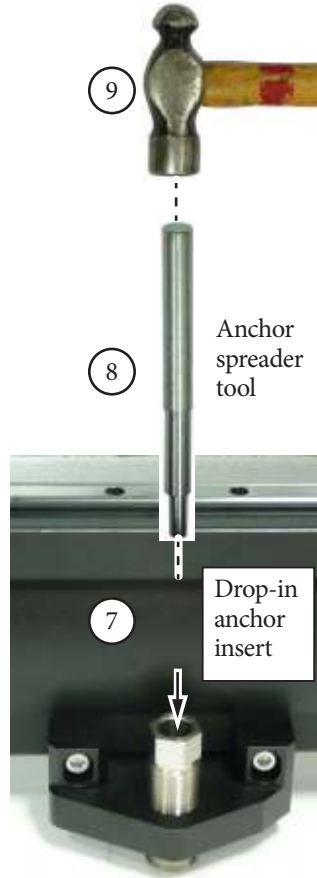
1. Put the drill bit into the drill guide and attach the bit to the drill. (The cutting end of the bit is too large to fit through the guide, so you must insert the other end into the guide, then into the drill.)

2. On one of the track anchor brackets, screw the sleeve all the way down to the floor, finger tight.
3. Insert the drill bit and guide into the threaded sleeve on the anchor bracket, so the drill bit is against the floor.
4. Put tape around the drill bit 5 cm above the guide. This will help you gauge the depth of the hole in the next step.



5. Drill a hole 5 cm deep into the concrete. When the tape reaches the top of the guide, drilling is complete.
6. Remove the drill bit and guide from the sleeve and clean the hole.

7. Put the drop-in anchor insert, threads upward, through the sleeve and into the hole in the concrete, 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, **being careful not to hit the track**.
10. Remove the anchor spreader tool.
11. With the sleeve still finger-tight against the floor, insert the retaining bolt through the sleeve and into the drop-in anchor insert, and tighten.



12. Repeat steps 2 to 11 for the other three anchor brackets on the track section.

Note

If you are not laying the track for Bolt X Track, for further instructions, proceed to *Laying subsequent track sections* on page 16.

## Using Weight Plates with Bolt X on Track

If you are using a fast robot with a long arm, such as Bolt X on Track, it is recommended that you hold the track down by bolting it to the ground as above. If that is not feasible, use the weight plates to lay under and then bolt the track on to the weight plates.

They are not a full substitute for a rigid fixing to a ground anchor and will not provide the same stability. Caution should therefore be exercised when using weight plates alone to stabilise a system.

MRMC have empirically tested the Bolt X to a **maximum speed of 180deg/s** on Joint 1 of the rig. A 6-plate system will provide the required safety at this speed.

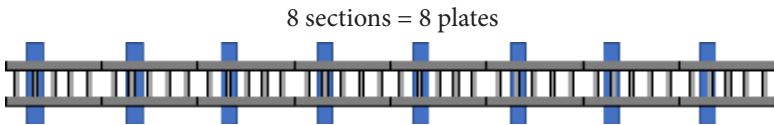
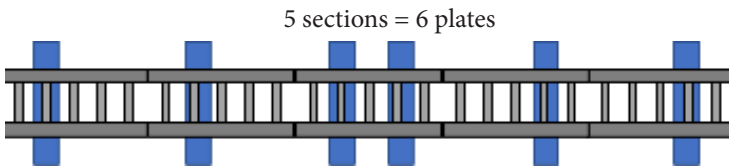
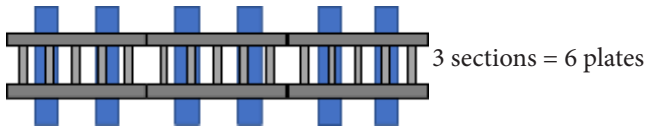
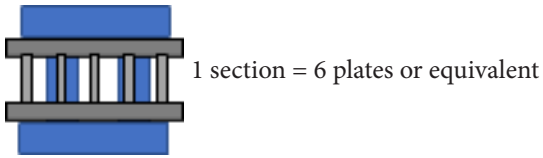
Note that this speed is highly unlikely to be practical in normal operation of the rig with weight plates only due to the movement which will occur, making it unsuitable for filming.

To avoid any significant gaps in the weight plate system for longer runs greater than 6 lengths an additional 1 plate per length of rail is required.

### Number of plates

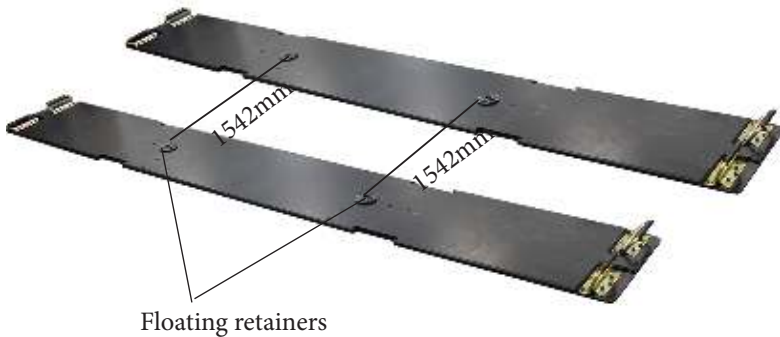
- Two plates for each 3m section of precision rail up to 3 sections.
- For systems with more than 3 sections of 3m rail 6 plates should be used up to a maximum of six sections, spaced evenly
- For more than 6 sections 1 additional plate per section is required
- For systems with less than 3 rail sections additional stabilising weights must be used, equivalent to 6 plates.

<b>Rail Sections</b>	<b>Plates Required</b>
Upto 3	Equivalent of 6 plates
3 to 6	6
More than 6	One plate per rail section, spaced evenly



## Laying the First Track Section – Bolt X on Track (with Weight Plates)

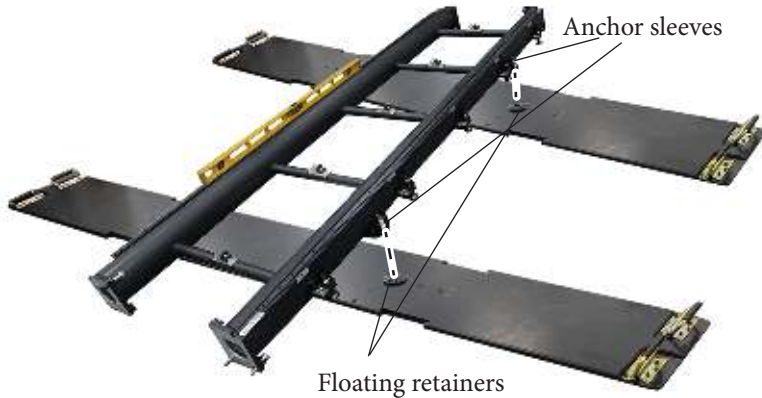
1. Carefully, 2 persons lift a weight plate from the crate and lay it such that it is perpendicular to the position of where the first track section is to be installed. (The position of the weight plate should be decided bearing in mind that the floating centre retainer on the floor plates would be directly under that first pair of anchor screws on the track.)



2. Similarly, 2 person lift the second weight plate centred to the approximate position of the second pair of anchor screws on the track. The second pair of anchor screws on the track section are 1542 mm from the first one.



3. Lay the first track section, placing the 4 x anchor screws on the track directly above the 4 x floating retainers on the floor plates.



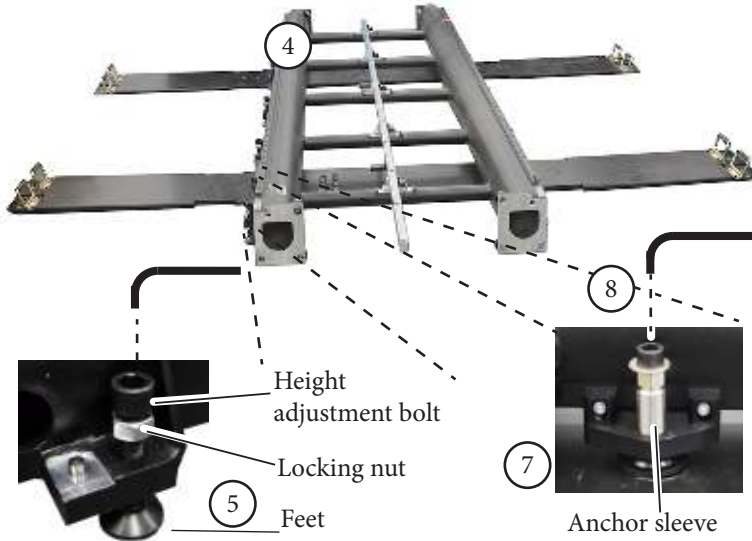
4. Level the track in both lengthways and widthways using a spirit level, by adjusting the four corner feet of the track. Make sure all four corner feet are touching the ground (no wobble).

Hint

The four corner feet also determine the track height. If you are laying track on a level floor, try to use the middle of the height adjustment range so that subsequent sections have some leeway (in their feet) to cater for any unevenness in the floor.

5. Tighten the lock nuts down against the track on the corner feet, being careful not to change the height.
6. Lower the six middle feet until they touch the ground (finger tight against the ground or the weight plate) and then tighten the lock nuts on them.
7. Screw one of the anchor sleeves all the way down to the floating centre retainers on the floor plate, finger tight.

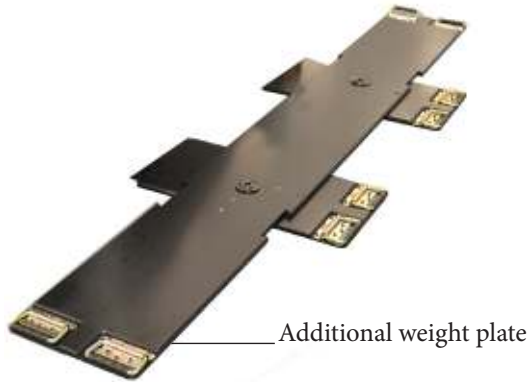
8. Insert the retaining bolt in the anchor sleeve and tighten it. Note that the floating centre retainers on the floor plates can be adjusted sideways slightly to match the retaining bolt.



- Repeat Step 7 and 8 for the remaining 3 anchor sleeves for the first track section.

Note

If you are using only one track section, use the above procedure to lay the track section and the weight plates and then place additional two weight plates across the weight plates already laid as additional weight.



## Laying the Second Track Section – Bolt X on Track (with Weight Plates)

- Again two-person lift the third floor plate in position next to the first track section such that the floating retainers of the third weight plate are 1429mm away from those of the second one.
- Lay the fourth weight plate parallel to the third one with floating retainers of the two 1542mm apart.
- Add the second track section and follow steps 3-9 in the *Laying the First Track Section – Bolt X on Track (with Weight Plates)* on page 12 section.
- The subsequent instructions for laying tracks are similar as that for other large rigs except that each track section require two floor

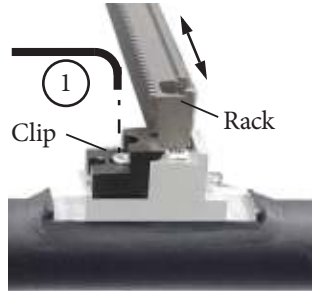
plates to go under first. Follow the subsequent sections in this Quick Start Guide for further instructions.

**Note**

Once the track is secured using weight plates, no other weights need to be added to the corners of the track.

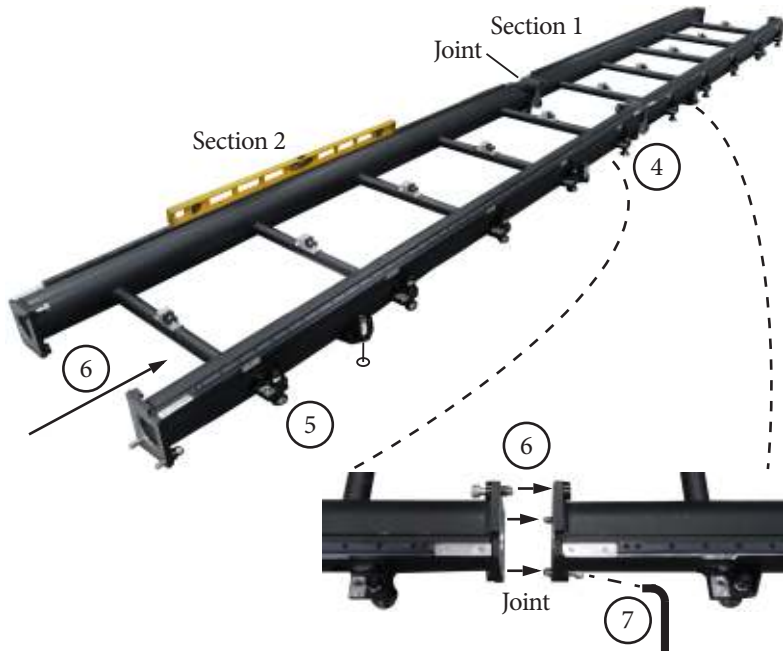
## Laying subsequent track sections

1. If any of your track sections already have a rack installed, loosen the rack clips so you can temporarily slide the rack along the track and out of the way when you are joining the track sections.
2. Lay the next track section in line with the previously laid track section and as close to it as possible, making sure it is the right way around (see the notes on page 2).



Again, if you will be using a fast rig such as Bolt and the floor already has anchor points from a previous installation, put the track anchors as close as possible to the existing holes.

3. Raise the middle feet and anchor sleeves of the new track section so they do not touch the ground.



4. Adjust the height of the new track section to match that of the previous section by adjusting the two corner feet nearest to the joint (one on each rail).
5. Level the new track section with a spirit level by adjusting the two corner feet furthest from the joint (one on each rail).
6. Slide the new track section along the floor against the previous track to firmly engage the ends of the rails. (Slide the new section — not the previous section.)

You might need to repeat steps 4 to 6 until you get good alignment of the rails at the joint.

7. Firmly tighten the six large bolts that hold the track sections together at the joint (three on each rail). You can also use these to help pull the track sections together, once they are at the same height.
8. On the new track section, tighten the lock nuts down against the track on the four corner feet.

9. On the new section, lower the six middle feet until they touch the ground (finger tight against the ground) and then tighten the lock nuts on them.
10. If you are using a fast rig such as Bolt, anchor the new track section to the floor as you did for the previous track section, using the procedures in *Anchoring the track* on page 7.

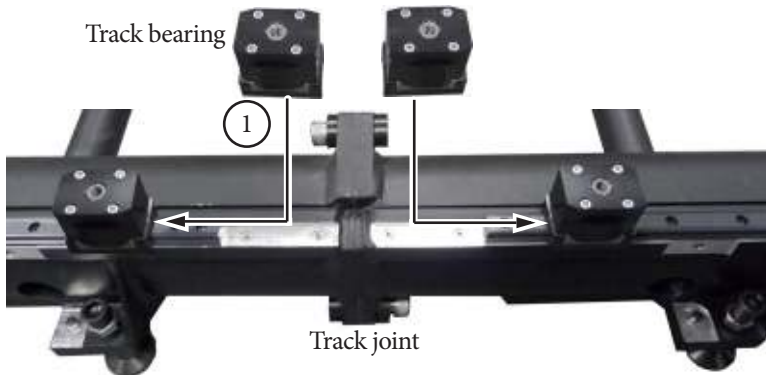
Repeat steps 1 to 10 in this section to lay additional sections of track.

The track section are shipped with the rack mounted on them. If you have removed the rack for transportation, see Appendix 3 *Mounting the rack* for instructions on mounting it on the track.

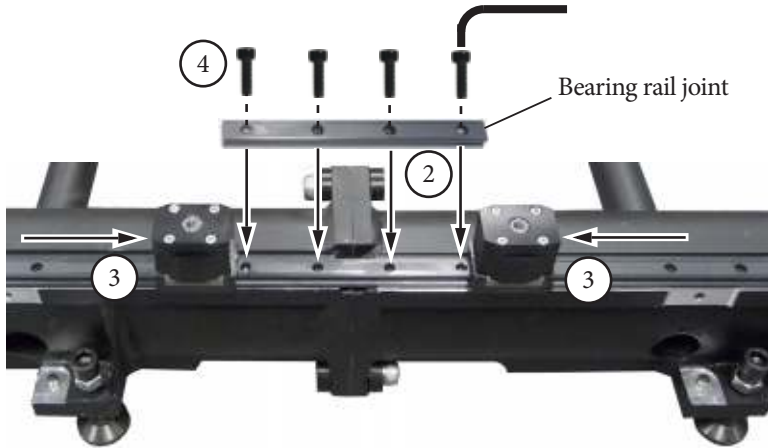
## Mounting the bearing rail joints

### Hint

Always mount and remove the track bearings with care. Try to keep them squared up and in-line with the bearing rail to avoid damaging them or loosing a bearing.



1. At one of the track joints, slide two track bearings over the ends of the bearing rails. Note that the track bearings for **Bolt X on Track** are different from these pictures.



2. Put one of the long bearing rail joints onto the track.

**Note – Bolt X on Track**

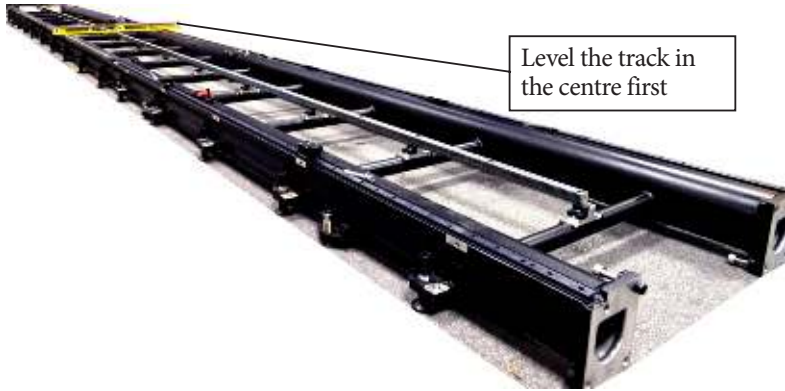
The rail joints for Bolt on Track have four additions threaded holes which require corresponding holes in the rails themselves. If they haven't been done already, use the rail joint holes as guides to drill holes in the rails.

3. Align the bearing rail joint with the existing rail by sliding the track bearings partially over the joint at each end.
4. Insert the bolts and tighten them.
5. Slide the track bearings along the rail to the next joint and repeat steps 1 to 4 for all remaining joints. For the track ends you use the short bearing rail pieces (with only two holes) and only one track bearing to help with alignment.

## Multiple Lengths of Track

1. Lay the first three lengths of track and join them together.
2. Treat the three lengths of track as one. Use the end corner feet of the multiple length with all intermediate feet of the floor.

3. Level the multiple length as one unit measuring the end to end level only in the centre of the entire group.





- Using only the middle pair of feet, bring the centre of the rail up to the level with the ends by measuring the level at the centre of the first half.

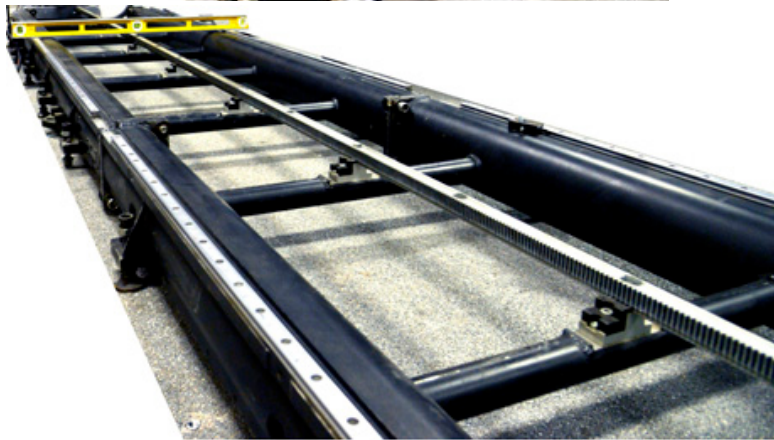


Level the centre of one half of the group





Level the centre of the  
other half of the group

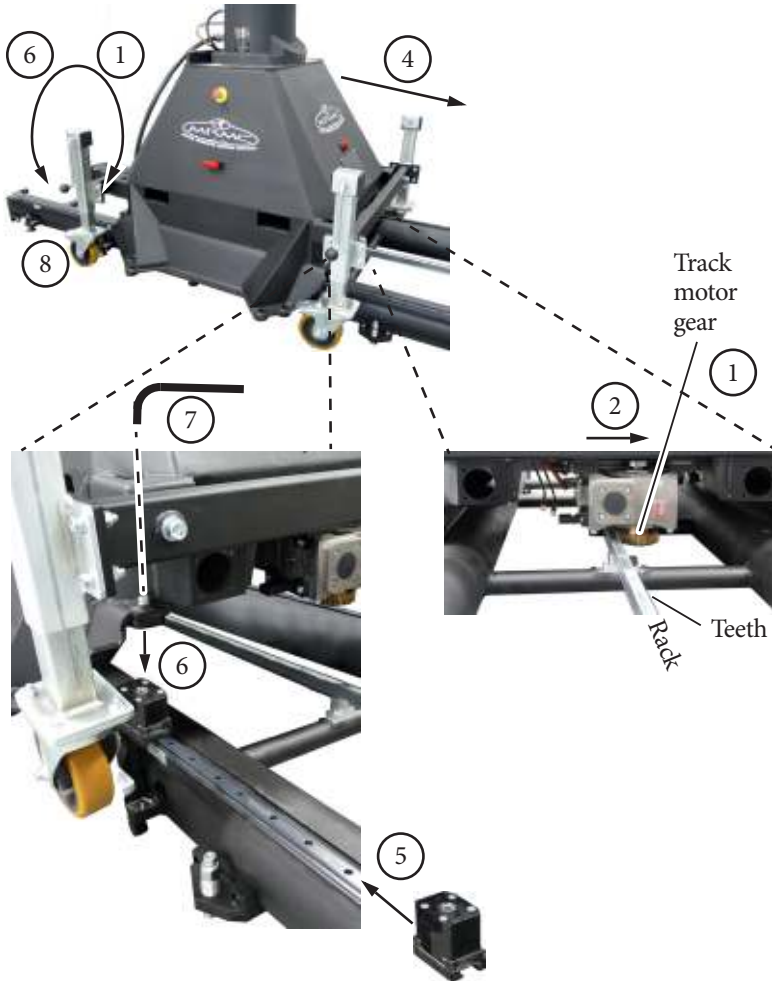


5. Push the rest of the feet down.
6. Extra lengths of the rail can then be added and individually levelled.

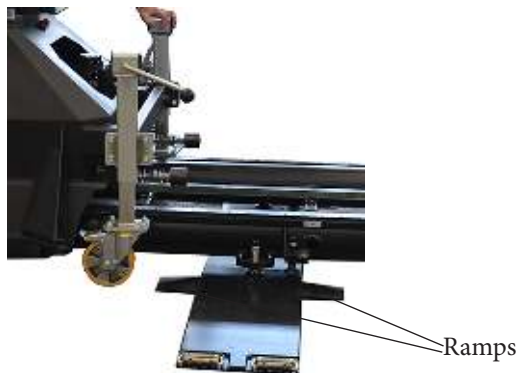
## Mounting Bolt (family of robots) on the track

This section tells you how to mount Bolt On Track onto Precision Track.

### Mounting Bolt on the track bearings



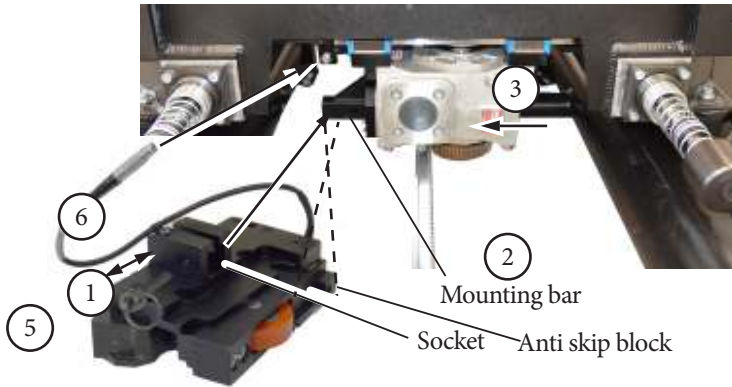
1. Roll the rig to a position just off the end of the track, raise the rig on its wheels high enough to go over the track using the wheel cranks, and rotate the rig on its wheels to be the correct way around so that the track motor gear on the rig underside is on the toothed side of the rack. **Do not engage the teeth yet; just make sure the rig is the correct way around for the track.**
2. On the underside of the rig, remove the pinch wheel if you haven't already done so and push the track motor out of the way on its sliding bearings, so that the track motor gear will not interfere with the Rack on the track. (For details of removing the pinch wheel, follow the procedure on page 26 in reverse order.) **Do not slide the pinion gear too far away from the rack when moving it into place, the rear (inner) track motor mounting bolt will hit the racking as you drop the rig down, preventing it from settling onto the bearings.**
3. Bolt X on Track: Add the supplied 4 x ramps on the first weight plate on the side where you are mounting the robot from.



4. Push the rig on its wheels over the track about a metre, being careful not to push the track motor gear against the rack while moving. For Bolt X on Track the ramps help slide the rig on the track with ease. Be careful that the wheels do not pivot sideways away from the ramp while pushing the rig on the track.
5. Push the four track bearings onto the ends of the track (two on each rail) and into position under the four corners of the rig base.

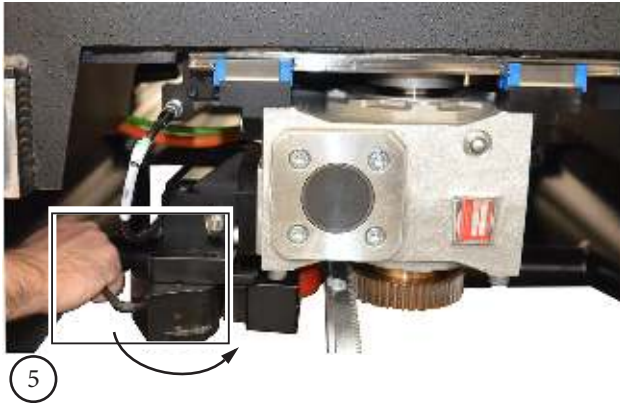
6. Carefully lower the rig onto the four track bearings, making sure that all four bearings are aligned with the corners of the rig base, and the track motor gear on the underside of the rig clears the rack.
7. Tighten the four track bearing mounting bolts at the corners.
8. Apply the brakes to the wheels to keep them from pivoting against the track (the brakes affect both rotation and pivot), and raise the wheels off the ground so the full rig weight is taken by the track. For Bolt X on Track, remove the ramps and store in a safe place to use them while taking the rig off the track and mounting again.
9. Feed out enough umbilical cable from your control area to reach the entire length of the track without stretching the cable. Make sure the area alongside the track is clear so that the umbilical cable doesn't catch on anything when the rig drags it alongside the track.
10. Attach the track motor pinch wheel on the underside of the rig, described in *Attaching the track motor pinch wheel to Bolt (Family of Robots) On Track* on page 26.

## Attaching the track motor pinch wheel to Bolt (Family of Robots) On Track



1. On the separately supplied pinch wheel assembly, remove the brass retaining pin by pulling on the ring.
2. Mount the pinch wheel assembly onto the track motor on the rig underside, by sliding the track motor gear against the rack and putting the pinch wheel Socket onto the track motor Mounting bar.
3. Push the track motor slightly towards the rail racking so that the track motor gear is in mesh with the rack.
4. Replace the retaining pin in the pinch wheel assembly by pushing on the ring (not the sleeve), to hold the assembly in place on the track motor.

5. Use the lever or an allen key into the pinch wheel CAM to pull it towards the rack until it snaps into position. This holds the track motor gear firmly against toothed side of the rack.

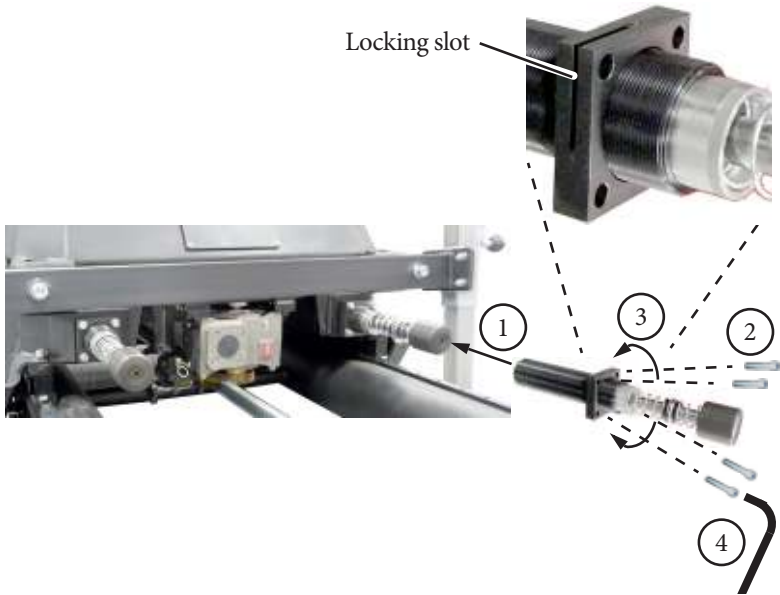


6. Connect the pinch wheel cable and use cable ties to hold it securely up away from the track.

Hint

The Limits and Datum magnets on the track are physically swappable (see page 40). Make sure you connect the Limit cable from the rig to the pinch wheel switch that is over the Limit magnet position on the track, and ditto for the Datum cable.

## Mounting the bumpers on Bolt (Family) of Robots on Track



1. Insert one of the bumpers into the hole in the base of the rig.
2. Insert the four retaining bolts through the bumper bracket and into the base, but do not tighten yet.
3. If you want, adjust how far the bumper extends from the rig by screwing it in or out of its threaded bracket.
4. Tighten the four retaining bolts on the bumper.



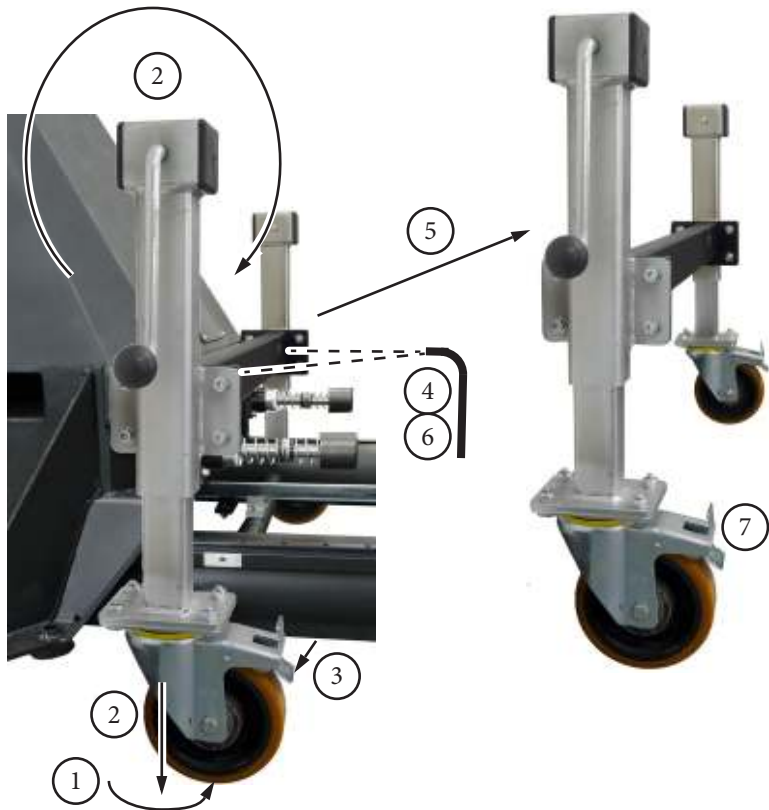
5. Repeat steps 1 to 4 to mount the other three bumpers.

**Hint**

One of the corners on the bumper bracket has a locking slot cut into it. Tightening the bolt on this corner flexes the bracket, which in turn locks the threaded cylinder of the bumper to prevent it from turning. To adjust the amount of bumper extension after the bumper is mounted you only need to loosen the bolt on the bracket corner with the locking slot. You can then turn the bumper in its bracket to adjust the amount of extension, and re-tighten the bolt when you have finished.

## **Removing the trolley wheels from Bolt (Family of Robots) On Track**

After mounting the rig on the track you can remove the two trolley wheel units that are on either side of the rig.



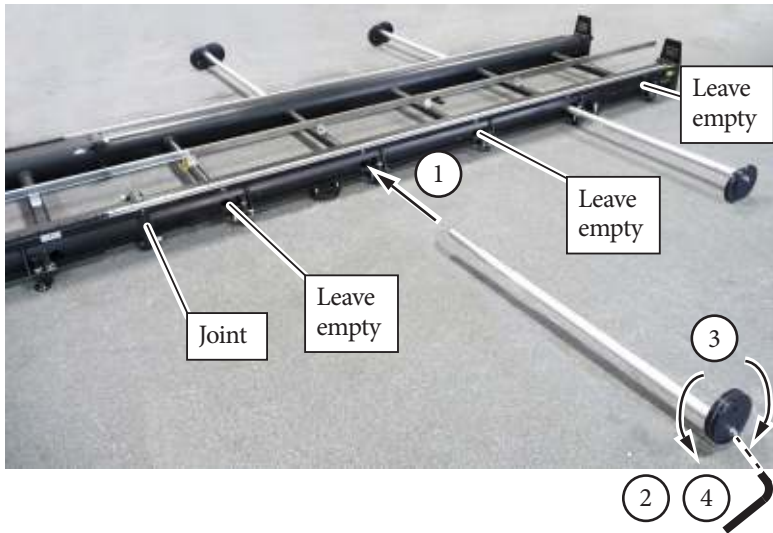
1. With the base of the rig supported by the track, pivot the wheels away from the rig.
2. Turn the cranks to lower the wheels to the ground.
3. Apply the wheel brakes.
4. Remove the two bolts holding the wheel trolley unit on the rig.
5. Lift the wheel unit away from the rig.
6. Insert the two wheel trolley retaining bolts back into the rig base, for safe keeping.
7. If you are going to store the wheels for weeks or months, release the wheel brakes so they don't leave a dent in the wheel rubber.

Notes

## Mounting a Milo or Titan on the track

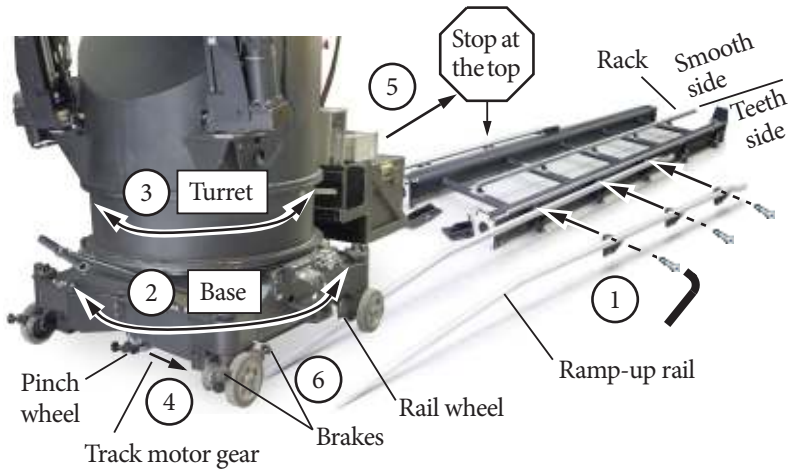
### Mounting outriggers on the track

The outriggers for Precision Track are a safety feature and **must** be always used for safety to prevent the rig tipping when assembling, disassembling or using a Milo Long Arm or Titan. You install four outriggers in each section of track. Leave the centre hole and end holes empty.

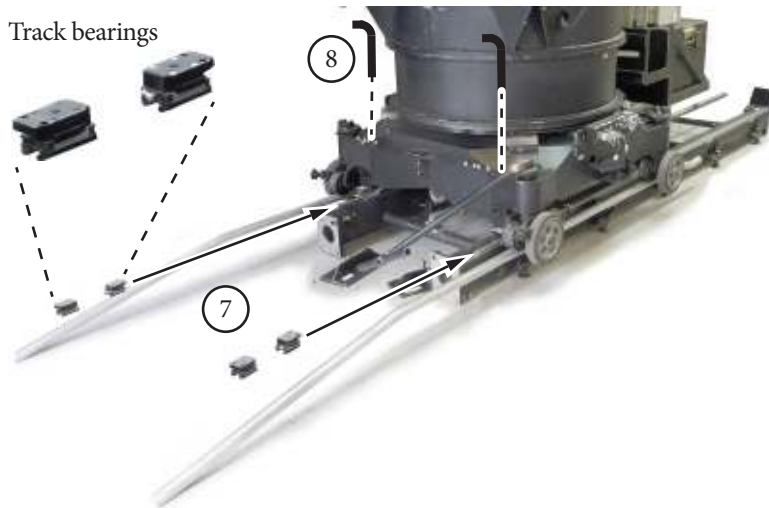


1. Insert the outrigger into an appropriate hole in the side of the track as far as it will go — this is about 340 mm, or about twice the length of the shiny tip of the outrigger.
2. Loosen the bolt on the end of the outrigger to allow the off-centre disks to rotate on the shaft.
3. Rotate the off-centre discs on the shaft in opposite directions until they both press against the floor, hand tight.
4. Re-tighten the bolt.
5. Repeat for the other three outriggers for the section, and for each section of track.

## Mounting a Milo or Titan on the track bearings



1. Attach the pair of ramp-up rails to one end of the track, using three bolts on each rail.
2. Roll the rig to a position just off the end of the track, making sure the base is the correct way around. The track motor gear on the underside of the rig must be on the toothed side of the Rack.
3. You can rotate the Turret later if you need to point the arm in the other direction along the track during the shoot. For now, point the arm parallel to the track to make sure the rig is balanced over the track.
4. On the underside of the rig, remove the pinch wheel if you haven't already done so and push the track motor out of the way on its sliding bearings, so that the track motor gear will not interfere with the Rack on the track. (For details of removing the pinch wheel, follow the procedure on page 36 in reverse order.)
5. Roll the rig on its wheels up the ramp, making sure that the rail wheels (with concave edges) are centred on the ramp-up rails. **Stop the rig when it is centred over the highest point on the ramp-up rails**, and **before** the rig reaches the small down-slope at the other end of the ramp-ups.
6. Apply the brakes.

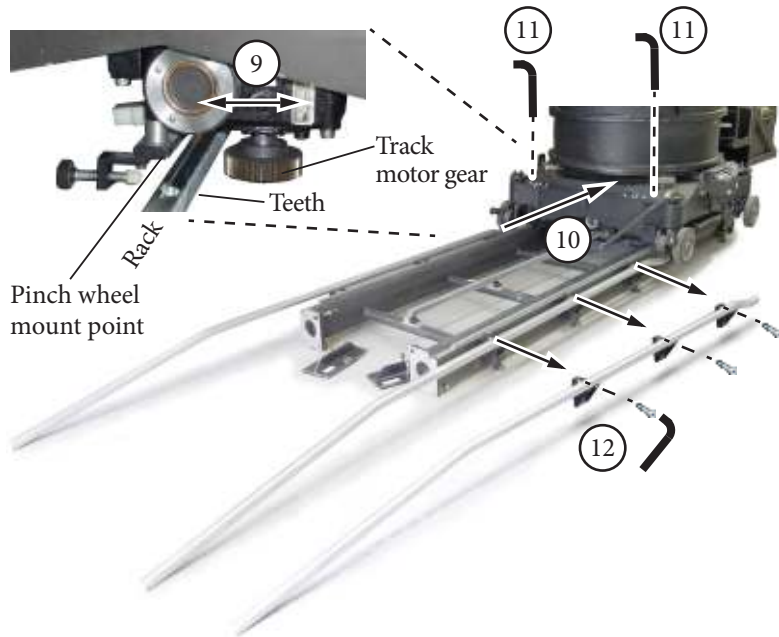


7. With the rig at the highest point on the ramp-up rails, carefully push the four track bearings onto the ends of the bearing rails (two on each rail) and into position under the four corners of the rig base.

Hint

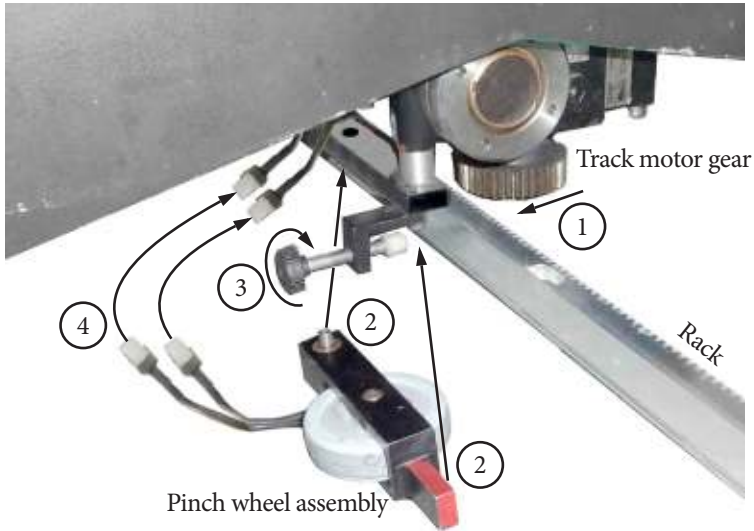
Always mount and remove the track bearings with care. Try to keep them squared up and in-line with the bearing rail to avoid damaging them or losing a bearing.

8. At each corner of the rig, use a hex key to push the captive bolt down into the track bearing and tighten to make sure the track bearing is lined up with the corner of the rig. You will not be able to tighten it completely yet because the rig is still sitting on the ramp-up rails and not on the track bearings.
9. Under the rig, move the track motor on its sliding bearings so that the Rack is centred between the track motor gear and the pinch wheel mount point. The purpose is to make sure that no part of the rig touches or interferes with the Rack when you push the rig the rest of the way onto the track in the next step.



10. Let off the brakes and push the rig further along the ramp, down the small slope, and the rest of the way onto the track. When you do this, make sure that each of the four track bearings fits into the recess at the corners of the rig.
11. Tighten the four track bearing mounting bolts at the corners.
12. Remove the ramp-ups from the track so that the rig has the full run of the track.
13. Feed out enough umbilical cable from your control area to reach the entire length of the track without stretching the cable. Make sure the area alongside the track is clear so that the umbilical cable doesn't catch on anything when the rig drags it alongside the track.
14. Attach the track motor pinch wheel on the underside of the rig, described in *Attaching the track motor pinch wheel to a Milo or Titan* on page 36.

## Attaching the track motor pinch wheel to a Milo or Titan



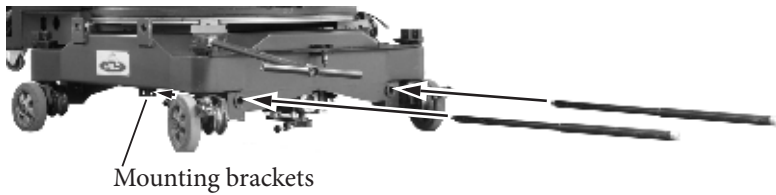
1. On the underside of the rig, slide the track motor gear against the rack.
2. Bolt the pinch wheel assembly onto the mounting point on the underside of the track motor and tighten the bolt.
3. Hand-tighten the pinch wheel adjustment bolt so that the rubber wheel presses firmly against the smooth side of the rack. This holds the track motor gear firmly against toothed side of the rack.
4. Connect the pinch wheel cables for the Limit Switch and Datum Switch to their corresponding connectors (usually labelled **L** and **D**) on the rig underside, and use cable ties to hold them securely up away from the track.

### Hint

The Limits and Datum magnets on the track are physically swappable (see page 40). Make sure you connect the Limit cable from the rig to the pinch wheel switch that is over the Limit magnet position on the track, and ditto for the Datum cable.



## Mounting the bumpers on a Milo or Titan



1. Insert one of the bumpers through the appropriate hole in the base of the Milo or Titan, and then into the mounting bracket until it clicks into place.
2. Repeat step 1 to mount the other three bumpers at the other three corners.

Notes

## Mounting the Limit Switch and Datum Switch magnets on the rack

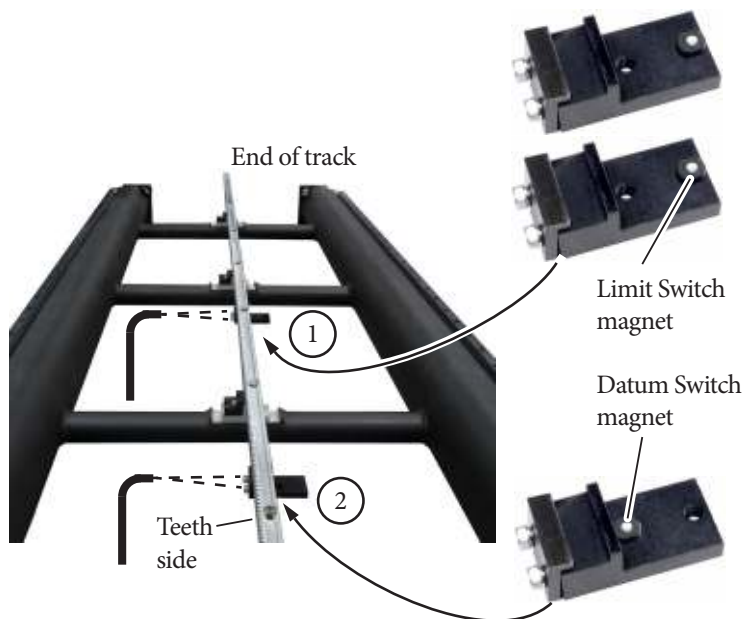
### About track limits

In a track-mounted rig there are typically three devices for limiting movement along the track to prevent the rig going off the end of the track:

- **Soft limits** - You configure these in the Flair Motion Control Software that controls the rig. When the system is working correctly the soft limits act as a barrier to other parts of the software such as programmed moves or live commands, so that no part of the software can move the rig beyond the soft limits.
- **Limit and Datum Switches** - The **Limit Switch** consists of a magnetic sensor located on the track motor pinch wheel on the underside of the rig, and two magnets which you mount at each end of the rack. The position of the magnets along the rack defines the ultimate limits, along the track, for the rig electronics. You define the soft limits within the range of the Limit Switch magnets, so that if the soft limits fail for some reason and the rig reaches one of the Limit Switch magnets, the system electronics automatically shut down any further movement and apply the brakes. A similar switch called the **Datum Switch** is used in combination with a single Datum magnet which you also mount on the rack but at a different distance from it. The Datum Switch defines a fixed reference point on the track for the electronics. The Flair software can then use this position as the home position or zero point, from which all movements and soft limits along the track are measured.
- **Buffers** - These are steel plates that physically prevent the rig from going off the end of the track if the previous two limits fail. Spring-loaded bumpers on the rig help to prevent damage to the rig or track, but you should never intentionally use the buffers to stop the rig. Mounting instructions are in *Mounting the buffers without weights* on page 44. For the Narrow Rail, the bumpers are mounted the Buffer bracket. For details, see *Mounting Buffers on Narrow Rail* on page 45.

## Mounting the magnets

Although you can mount the magnets for the Limit Switch and Datum Switch on the rack at any time, you ordinarily do this after mounting the rig on the track so that you can precisely adjust the height of the magnets relative to the magnet sensors on the pinch wheel on the underside of the rig.



The bracket that holds the magnet has two holes, and there is no convention regarding which hole to use for the Limit magnets and which to use for the Datum magnet. Whichever arrangement is used, the two brackets with an identical arrangement are used for the Limits at the ends of the track, and the bracket with the magnet in the other hole is used for the Datum which is between the Limits.

The track motor pinch wheel on the underside of the rig has two switches (sensors) that run over these two magnet positions — one switch for the Limits and one for the Datum.

When you install the pinch wheel and connect the rig's Limit and Datum cables to the switches on the pinch wheel (page 26 for Bolt or page 36 for Milo or Titan), you must make sure that you connect the Limit cable to

the switch that is in the Limit magnet position, and the Datum cable to the switch that is in the Datum magnet position.

1. Mount the two Limit Switch magnets (the two brackets that have the magnet in the same hole) onto the underside of the rack — one at each end of the track about a metre from the end. The actual distance depends on your requirements and on which side of the rig your Limit Switch is on (located on the track motor pinch wheel on the underside of the rig). Position the magnet along the rack so the Limit Switch on the pinch wheel goes over the magnet before the rig hits the physical end of the track with plenty of room to spare.
2. Mount the Datum Switch magnet (the bracket that has the magnet in the other hole) onto the underside of the rack, usually about 0.2 metres in from one of the Limit Switch magnets depending on your requirements.
3. Power up the rig and roll it slowly over each magnet, checking for clearance between the magnet on the rack and the sensor on the pinch wheel assembly on the underside of the rig. Adjust the height of the magnet (by loosening and re-tightening the bracket, and screwing or unscrewing the magnet in the threaded hole) to give 1 to 2 mm of clearance between the magnet and the sensor.

Caution

Mounting the magnets too high can damage them, as they can come into contact with the pinch wheel assembly on the underside of the rig.

To adjust the magnet when the rig is over it, remember to observe safety procedures to disengage the robot and make use of the E-stops so that the rig does not move when you are working under it.



## Mounting the weight wings and buffers

If you are using a fast rig such as Bolt On Track but anchoring the track into the floor is not feasible, you can alternatively attach optional weight wings (supplied with specific rigs only) to the ends of the track and hold the track down with weights. The weight wings fit between the track ends and the buffers.

### Hint

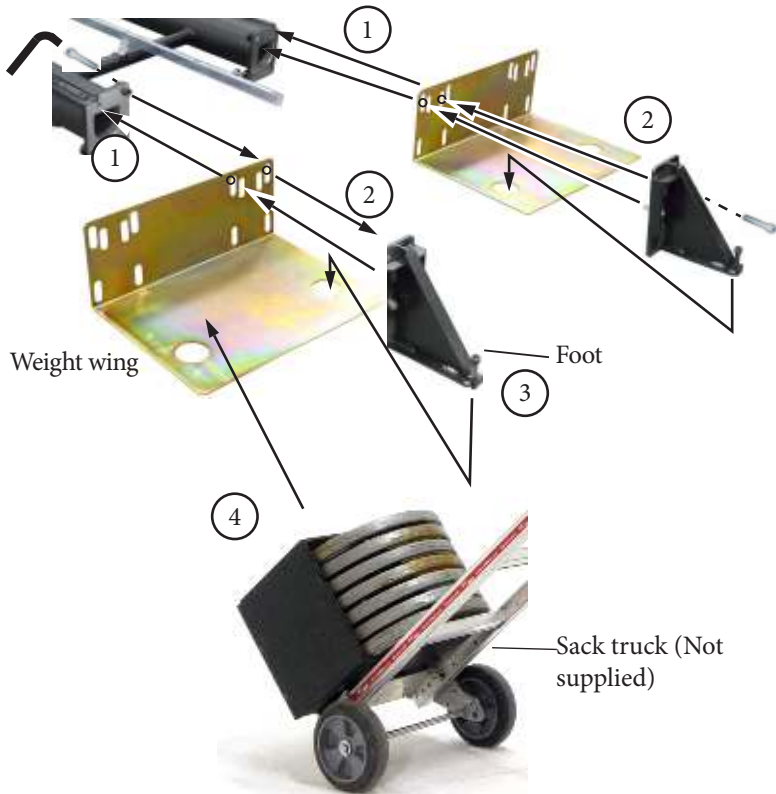
Using weight wings will not give you the same level of repeatable stability as anchoring the track to the floor, but will give you enough stability to operate Bolt On Track safely without tipping the rig over.

You ordinarily mount the weight wings and buffers after you have mounted the rig on the track, although you can mount the rig on the track later if have a forklift that can lift the rig high enough to go over the track from the side.

If you are going to mount the rig later, slide the track bearings onto the bearing rails now, before mounting the weight wings and buffers. If you forget to do this then when you mount the rig onto the track you will need to temporarily remove the bearing rail end pieces in order to get the track bearings onto the bearing rails.

### Note

Weight buckets are only supplied with certain rigs. Contact MRMC to learn if your rig accompanies weight buckets.



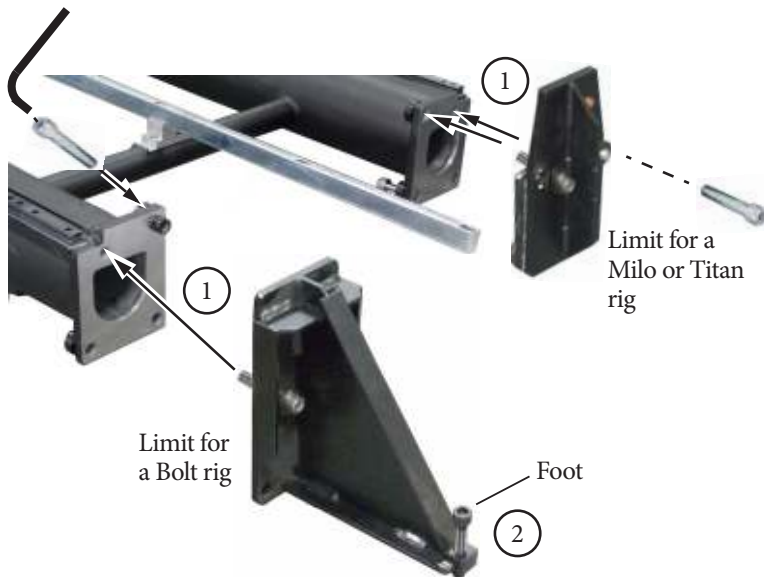
1. Put the first weight wing into place on the end of the track, resting on the floor.
2. Bolt the left buffer onto the end of the track, using one bolt from the buffer side and another from the end of the track. You might need to remove bolts from the track joint to make room for the bolts coming through from the buffer side. Bolts are not necessary at the bottom of the limits.
3. Screw the foot down against the floor, finger tight only.
4. Wheel the weight bucket onto the wing. Each box contains 140 Kg of weights ( $7 \times 20$  kg).
5. Bolt the right buffer onto the end of the track using the two bolts from side of the buffer.

- Repeat steps 1 to 5 for the other two weight wings and buffers on the other side of the track so you have two boxes of weights mounted at each end of the track.

## Mounting the buffers without weights

You ordinarily mount the buffers after you have mounted the rig on the track, although you can mount the rig on the track later if you have a forklift that can lift the rig high enough to go over the track from the side.

If you are going to mount the rig later, slide the track bearings onto the bearing rails now, before mounting the buffers. If you forget to do this then when you mount the rig onto the track you will need to temporarily remove the bearing rail end pieces in order to get the track bearings onto the bearing rails.



- Bolt one of the four buffers (mechanical limits) onto one end of the track, using two bolts in the upper holes. You might need to remove bolts from the track joint to make room for the bolts coming through from the buffer side. Bolts are not necessary at the bottom of the limits.



2. If you are mounting a limit for a Bolt On Track rig, screw the foot down against the floor, finger tight only. The buffer for a Milo or Titan rig doesn't have a foot.
3. Repeat steps 1 to 2 for the other three buffers so you have two limits mounted at each end of the track.

### Mounting Buffers on Narrow Rail



1. Bolt one of the four buffers (mechanical limits) onto one end of the track, using two bolts in the upper holes. You might need to remove bolts from the track joint to make room for the bolts coming through from the buffer side.
2. Repeat steps 1 to 2 for the other three buffers so you have two limits mounted at each end of the track.

3. If the bumpers are not already mounted, add the bumpers on all buffers by tightening them using a C-spanner.



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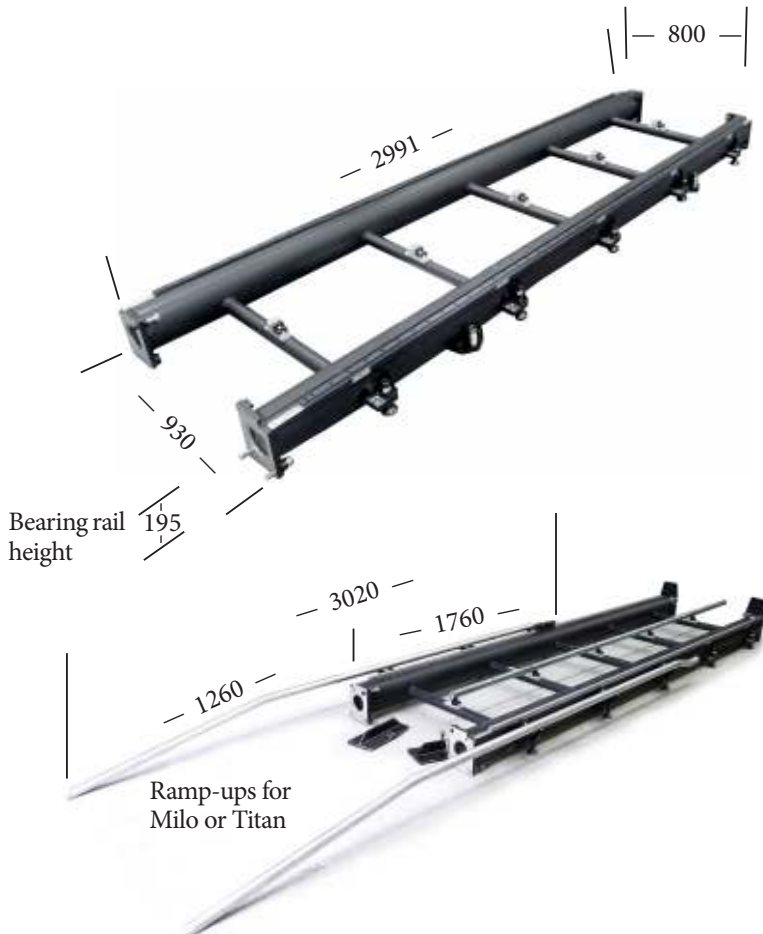
## Appendix 1 Specifications

### Precision Track

Weight: 95 Kg per section including the rack  
21 Kg per pair of ramp-ups  
140 Kg for each box of weights  $\times$  4 boxes if using weight wings.  
186 kg for each floor weight plates (only for Bolt X on Track)

Dimensions: All measurements are in mm:

Bearing rail  
spacing  
centre-to-centre

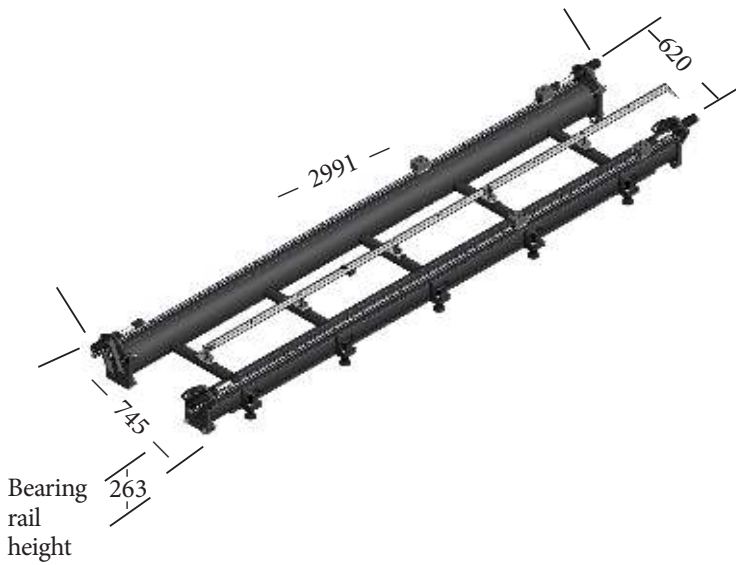


## Narrow Rail

Weight: 112kg per section including the rack

Dimensions: All measurements are in mm:

Bearing rail  
spacing  
centre-to-centre



## Appendix 2 **Cleaning and Maintenance**

### **General Care**

Precision rail is very tough but needs some regular attention to keep it in good condition.

Do not leave wood screws or board screws on the rail when set building, if they are driven over with a rig they can destroy a bearing and seriously damage the rail.

### **Cleaning**

#### **Rail**

The rail should be cleaned occasionally, especially after a dirty shoot or and outdoor shoot. It is usually best to clean with a normal surface cleaning spray, but it is wise to give a coat of WD40 or equivalent after this to protect the surfaces. The rack may need frequent cleaning with a fine brush to remove dirt and grit, especially after outside or beach shoots.

Any surface wetness such as after a rain shoot, should be wiped off immediately after the shoot, and a coating of WD40 used on the Precision Bearing Rail. During a rain shoot, the surface water should be wiped off the bearing rail as often as possible, as any water build-up in the precision bearings will cause them to jam. The hard coating on the bearing rail will only fail if subjected to severe temperature gradients over a long time. Do not leave precision rail out in your local desert.

#### **Bearing Rail**

It is not necessary to lubricate the bearing rail other than as above as the bearings themselves of the rig will leave a deposit of grease if they are properly greased.

#### **Feet Bolts and Anchor Sleeves**

It will be necessary occasionally to grease the threads of the feet bolts to ensure they do not seize over time and make levelling difficult. The same applies to the anchor sleeves if they have been used for fixing to a floor.

## **Joiner Pieces**

The 10cm long cutout on the fabrication for the joiner pieces should be carefully cleaned every time a rail joiner is placed.

## **Track Bearings**

The Track Bearings should be frequently greased using a good quality grease gun, again from a motor factor; the grease is Brown Low Melting grade. This should be done at least once per month if the machine is busy and especially in sandy or gritty environments. The bearings should be pumped with grease into one end grease nipple with the bearing on the rail moving slowly along; until the dirty grease stops coming out around the sides onto the rail.

Running with dry bearings will be noisy and produce loose shaky shoots, and will considerably shorten the life of the bearings and the bearing rail. As soon as any track bearing becomes slightly loose on the rail or noisy, or has been damaged or has any balls missing from its four raceways, it should be replaced.



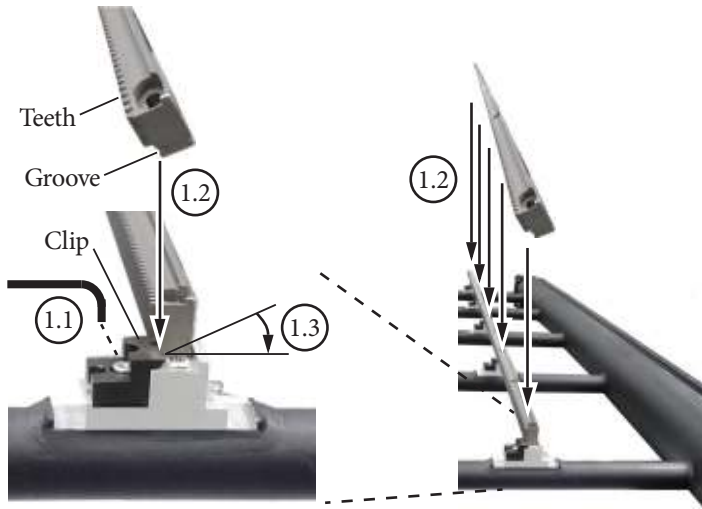
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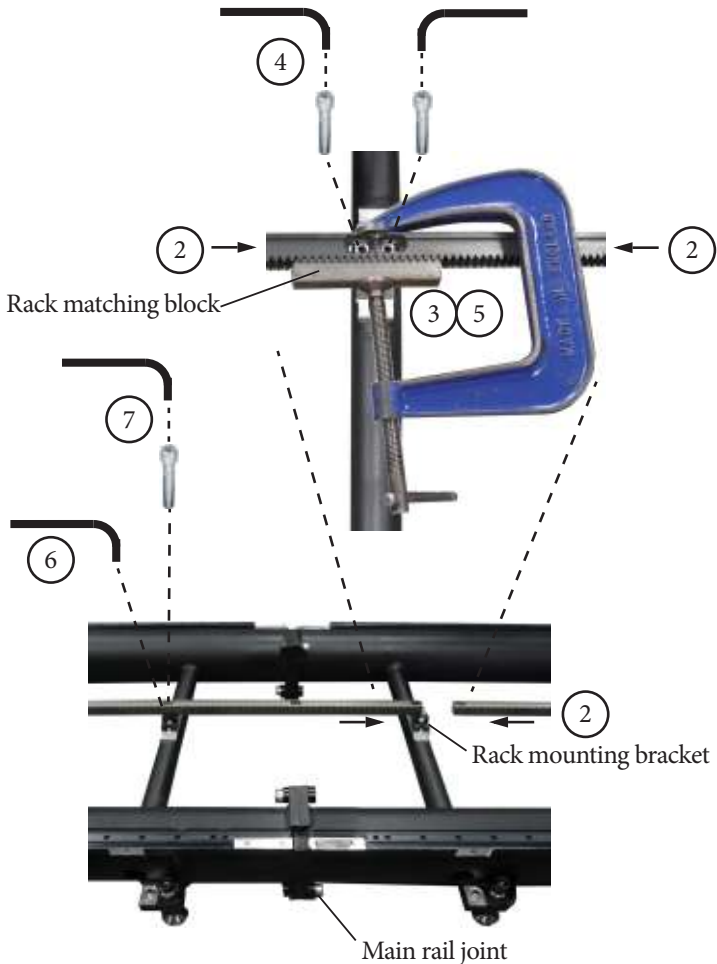
## Appendix 3 Mounting the rack

### Mounting the rack

1. If your track sections do not yet have the racks mounted on them, do this now for each track section as follows:
  - 1.1 Loosen all the rack clips on the track section.



- 1.2 Lay the rack into the brackets on the track, tilted as shown, making sure that the clips on the track go into the groove on the rack, just under the teeth.
  - 1.3 Twist the rack to lay flat in the brackets. Do not tighten the clips yet.
  - 1.4 Repeat steps 1.1 to 1.3 for each track section.
2. In the middle of the track, slide two of the racks together end-to-end, so that the joint between them is centred over one of the rack mounting brackets near the main rail joint.
3. Make sure the rack joint has the correct spacing by clamping a rack matching block to it, teeth meshed, using a vice.
4. Insert the two retaining bolts through the ends of the racks and into the mounting bracket (one on each side of the joint), and tighten.



5. Remove the vice and rack matching block.
6. Tighten all rack clips on the two adjoining sections of track.
7. If you are using a high-speed rig such as Bolt, also secure the rack with an extra bolt through the rack at every mounting bracket. This is not usually necessary for slower standard rigs.
8. Repeat steps 1 to 7 to mount the rack on all remaining sections of track, working outwards from the centre track section.

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