



Mark Roberts Motion Control

MODULA



QUICK START GUIDE

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Part number: MRMC-1330-00

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Contents

Chapter 1	Assembling the hardware	1
	Safety.....	1
	Overview.....	2
	Short rigs.....	4
	Tall rigs based on the lift column	6
	Tall rigs based on the turret.....	8
	Adjusting the wheels.....	10
	Mounting the Modula on a track.....	11
	Mounting the Modula on the track bearings	11
	Mounting the track motor gear and pinch wheel.....	14
	Mounting the dome and Mitchell riser onto the base....	16
	Mounting a tripod onto the base	17
	Mounting an Ulti-head onto a Mitchell plate.....	18
	Mounting the lift column onto the base	19
	Mounting the rotation ring onto the base	20
	Mounting the turret onto the rotation ring	21
	Mounting an Ulti-head directly onto the lift column or turret	22
	Mounting the Mitchell riser onto the lift column or turret	23
	Mounting the weight cage onto the rotation ring.....	24
	Mounting the arm onto the lift column.....	26
	Mounting the arm onto the turret	27
	Mounting the ball screw lift onto the turret.....	28
	Mounting the swan neck onto the arm	29
	Mounting an Ulti-head onto the swan neck.....	30
	Connecting the cables	32
	Ball screw lift connections.....	35
	Head connections	36
	Cable connection notes.....	37
	Specifying the new hardware configuration in Flair	38

Appendix 1	Modula panels.....	40
	Panel summary.....	40
	Connector pin-out information.....	43
	Axis connector	43
	Data Down connector	44
	Data Up connector	44
	E-Stop connector	45
	Mains In connector	45
	Mains Out connector	46
	Service connector	46
Appendix 2	Specifications.....	47

Chapter 1 Assembling the hardware

Safety

- Due to the size and weight of the Modula components, it is recommended that you use **two** people to assemble it.



- Do not use around flammable gas. All electrical equipment can generate sparks that can ignite flammable gas.
- The Modula has powerful motors that can pinch, so take care not to get your hands trapped in the rig or cabling.
- Keep the equipment dry. The system has **not** been made weatherproof. Do not use with wet hands.
- Keep cables tidy. Use cable ties to keep them out of harm's way. If you have a head with slip rings then make use of them; avoid running any cables between the Modula and the rotating head or camera if possible.
- Use a 240V AC power supply that is properly **earthed** (grounded). This is not only for safety reasons; electrical noise on an unearthed system can make axes controller boards trip out unpredictably, interrupting the shoot and creating intermittent problems that can be difficult to trace.

Overview

Thank you for using the Modula motion control rig from Mark Roberts Motion Control (MRMC). The Modula is designed for reliable day-in, day-out use in professional studio and Outside Broadcast environments.

You will also need:

- A Windows PC running **Flair** Motion Control Software.
- An **RT-12** or **RT-14** interface box, which handles the connections between the PC and the Modula rig.
- Optional **controllers** such as a Hand-Held Box (HHB), MSA-20 Handwheels, or Pan Bars.

The Modula family of interchangeable components allows you to custom-build a camera control rig in a variety of sizes to suit your changing day-to-day filming requirements.

All rig configurations are intended to be used on a track. The removable wheels are only designed for moving the rig between locations, and they do not give the amount of stability required for a shoot. You can mount the base on the track before or after you have built the rig.

The following sections provide summaries of the rigs that you can build, which fall into three main types:

- *Short rigs* on page 4. In these rigs the head is mounted onto a **Mitchell riser** or **Ronford Baker tripod**, which in turn is mounted on the Modula base:



- *Tall rigs based on the lift column* on page 6:



- *Tall rigs based on the turret* on page 8:

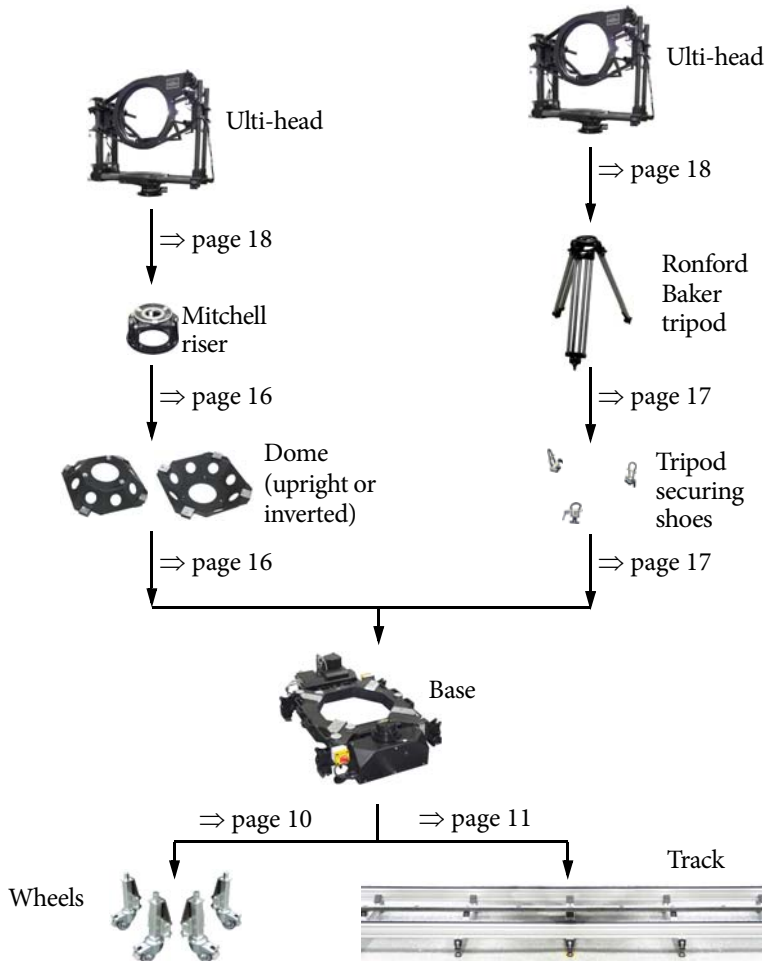


Short rigs

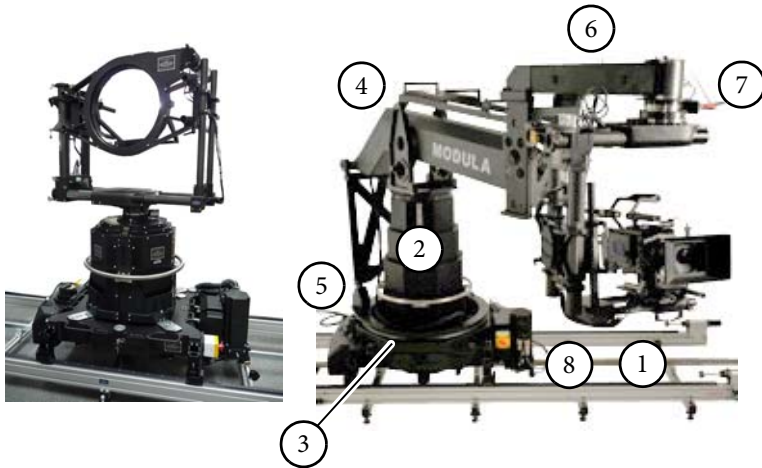
The next pictures show two typical short rigs that you can build with Modula components.



The components that you need to build these rigs are shown in the next diagram, along with references to the relevant pages for instructions on how to join together each pair of components. You build the rig from the base up.



Tall rigs based on the lift column

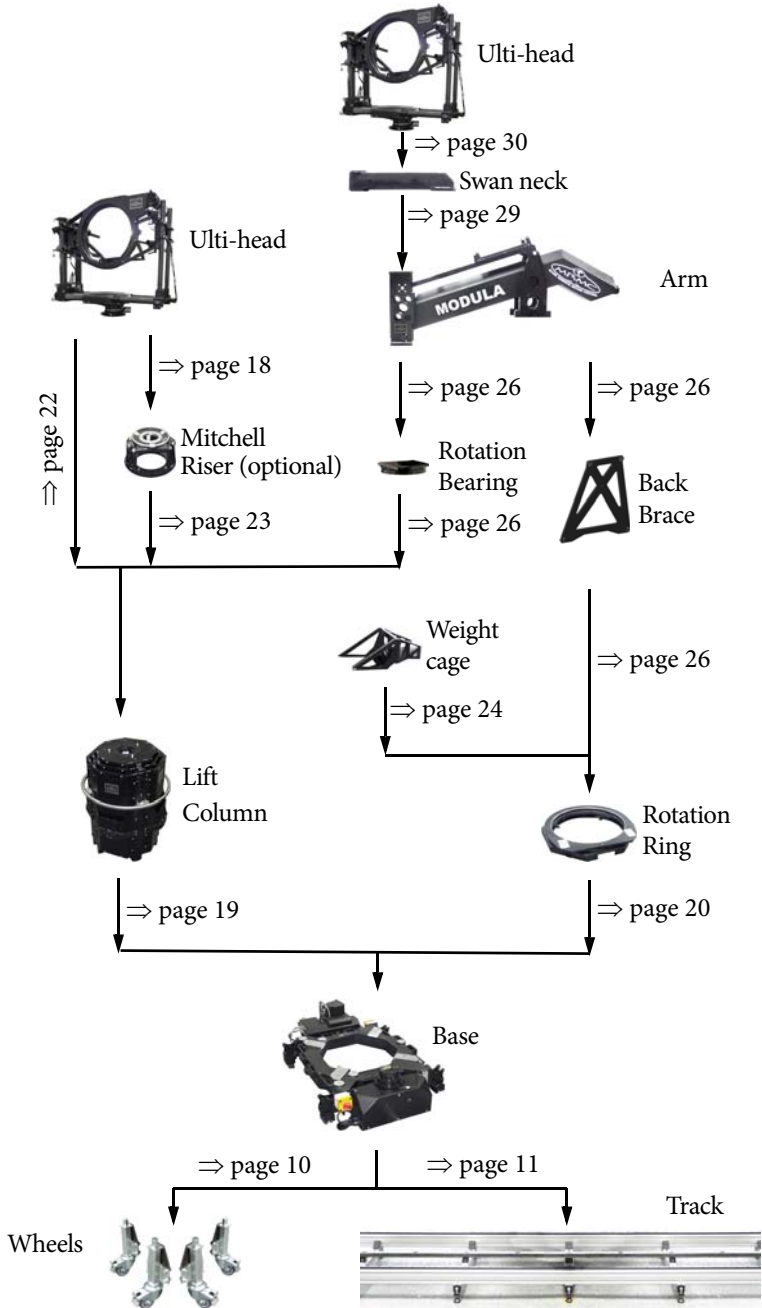


The components that you need to build these rigs are shown in the next diagram, along with references to the relevant pages for instructions on how to join together each pair of components. You build the rig from the base up.

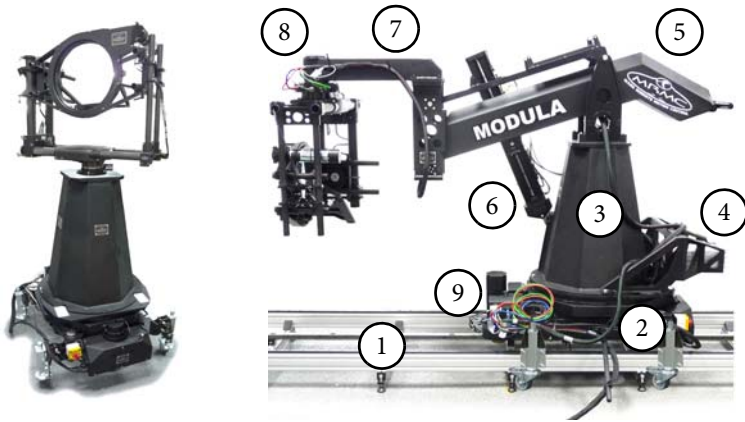
On the rig without the arm, you can use an optional Mitchell riser between the head and lift column if you want extra height. **Do not** feed cables through the middle of the lift column.

For the lift-column-based rig with the arm, the order of assembly is as follows:

1. Mount the base on a track - page 11. You can build the rig on the track, or built it on the wheels and mount it on the track later.
2. Mount the lift column - page 19.
3. Mount the rotation ring - page 20.
4. Mount the rotation bearing, arm, and back brace - page 26.
5. Mount the weight cage and weights - page 24.
6. Mount the swan neck - page 29.
7. Mount the head - page 30.
8. Connect the cables - page 32.



Tall rigs based on the turret

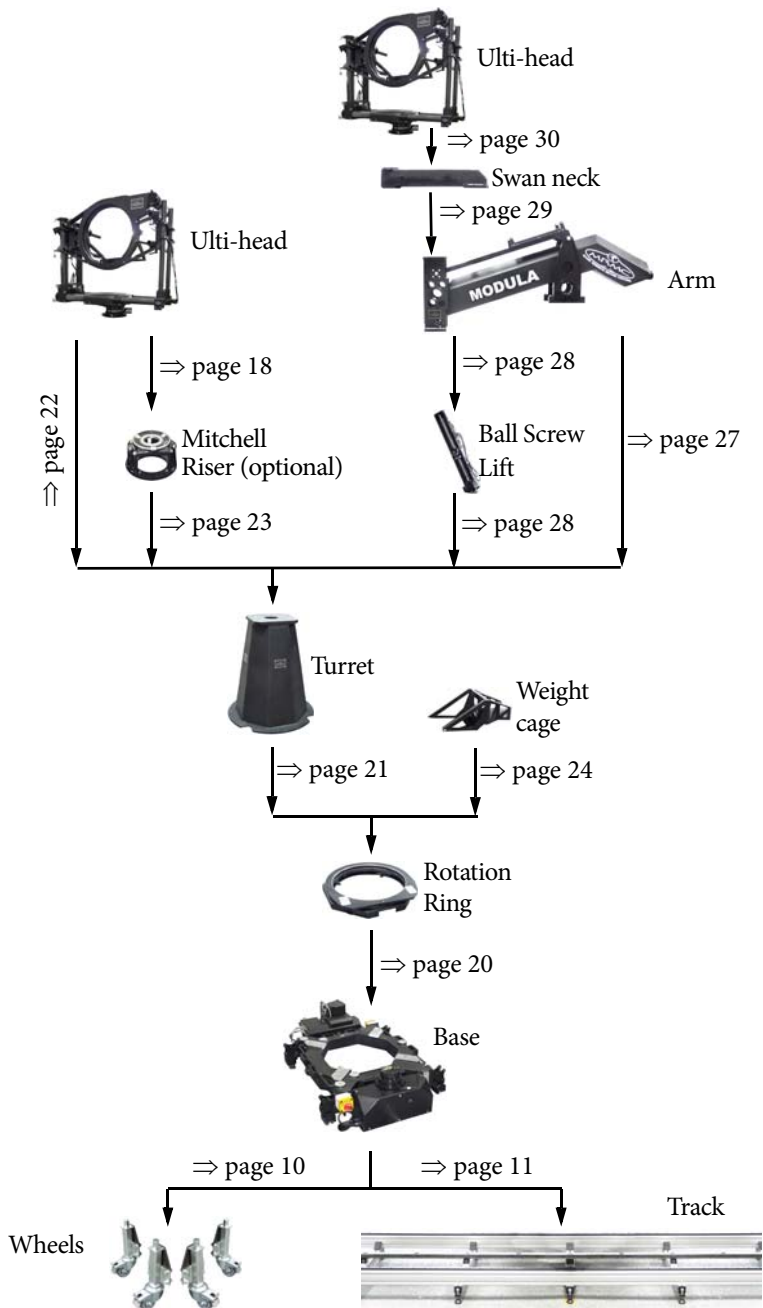


The components that you need to build these rigs are shown in the next diagram, along with references to the relevant pages for instructions on how to join together each pair of components. You build the rig from the base up.

For the turret-based rig without the arm, you can use a Mitchell riser between the head and turret if you want. A Mitchell riser gives you extra height and allows you to run cables under the head, through the middle of the turret.

For the turret-based rig with the arm, the order of assembly is as follows:

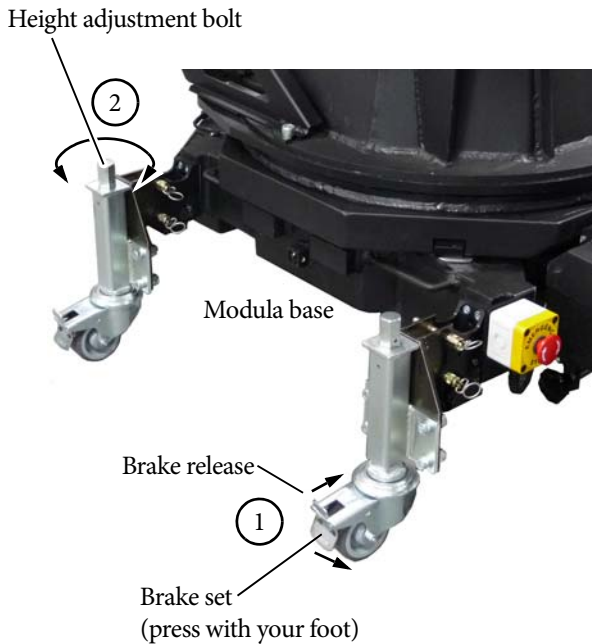
1. Mount the base on a track - page 11. You can build the rig on the track, or built it on the wheels and mount it on the track later.
2. Mount the rotation ring - page 20.
3. Mount the turret - page 21
4. Mount the weight cage and weights - page 24
5. Mount the main arm - page 27.
6. Mount the ball screw lift - page 28.
7. Mount the swan neck - page 29.
8. Mount the head - page 30.
9. Connect the cables - page 32.



Adjusting the wheels

The wheels are for moving the Modula rig between shooting locations. The shooting itself is done when the Modula is on the track — not on the wheels.

You can adjust the height of the Modula wheels to help you mount the Modula on the track, even when the Modula is fully loaded with a complete rig. For maximum stability when building or moving the Modula you should use the lowest wheel setting that is practical. You set each wheel independently, one at a time, as shown below.



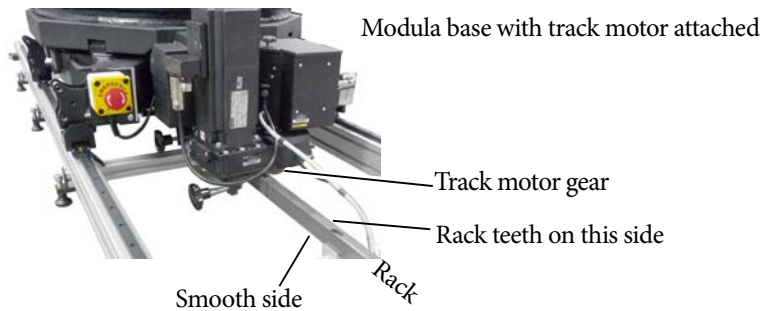
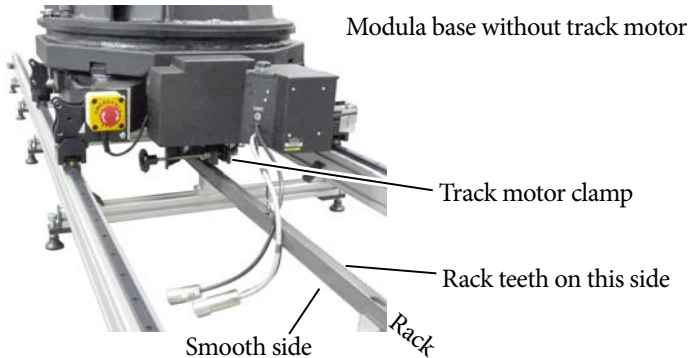
1. To move the rig on the wheels, release the brake on each wheel.
2. Turn the Height adjustment bolt to raise or lower the column. Adjust the height of the columns relative to each other to remove any wobble in the base.

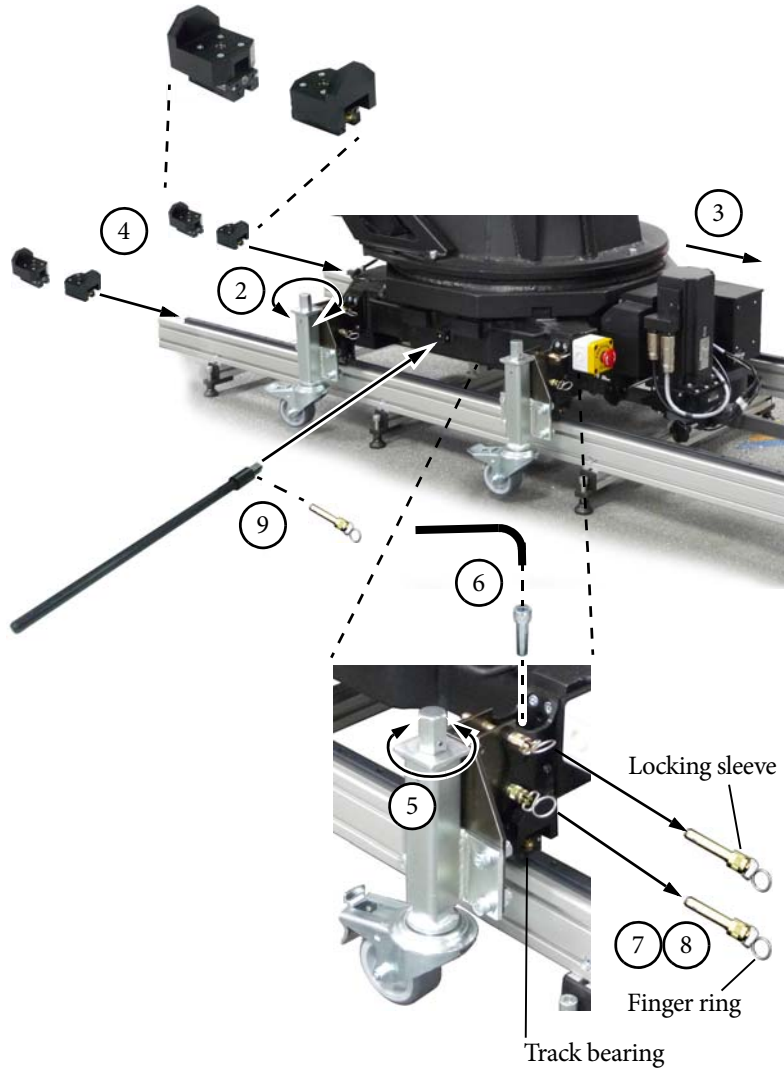
Mounting the Modula on a track

These instructions describe how to mount a heavy, fully built rig onto the track. If you want, you can mount the base on the track first and then build the rig on the track.

Mounting the Modula on the track bearings

1. Roll the Modula to a position just off the end of the track, and rotate the base on its wheels to be the correct way around for the track. The base must be oriented so that when you install the track motor gear later in these instructions, the gear engages with the toothed side of the rack. Use the pictures below to help you orient the base, but do not install the track motor gear yet. If the track motor gear is already installed on the base you can leave it in place.





2. Rotate the wheel caps to raise the Modula on its wheels high enough to go over the track with about 7 cm of clearance.
3. Roll the Modula on its wheels over the track about a metre.

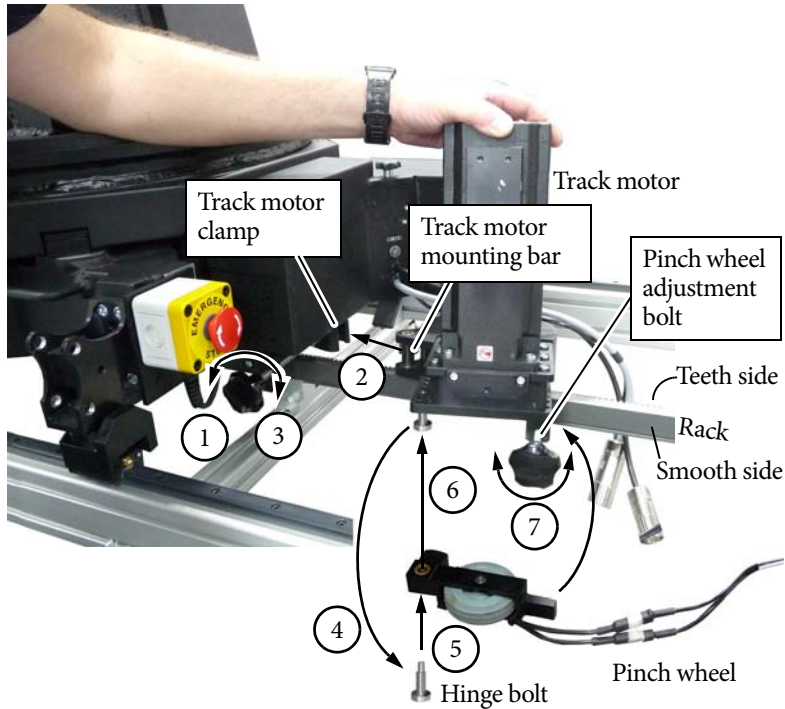
4. Push the four track bearings onto the ends of the bearing rails (two on each rail) and into position under the four corners of the Modula base.

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 loosing a bearing.

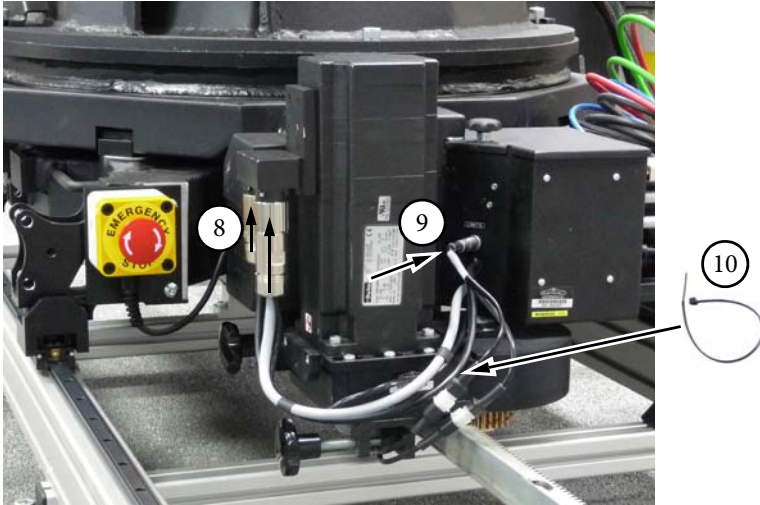
5. Carefully lower the Modula onto the four track bearings, making sure that all four bearings are aligned with the corners of the Modula base. If the track motor is already installed, make sure the track motor gear on the underside of the Modula clears the rack. (The track motor pivots on its mounting clamp so you can move the track motor gear out of the way to clear the rack.)
6. Insert and tighten the four track bearing mounting bolts at the corners. You might have to raise or lower the base slightly so you can nudge the track bearings into perfect alignment and then completely tighten the bolts.
7. Raise the wheels off the ground and remove them by pulling out their retaining pins (two on each wheel). You must remove the wheels so they don't hit any track components when the rig is moving along the track.
8. Insert the pins back into the wheel units for safe keeping away from the rig. (Remove and reinsert the pins by using the finger ring only, not the locking sleeve.) 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.
9. Attach the cable guide arm by inserting it into the socket in the base and inserting its retaining pin. You will tie the umbilical cable to this later, to hold the cable away from the track when the rig is moving along the track. You can attach the cable arm on either side of the base, in order to put it on the same side of the track as your computer stack.
10. Attach the track motor gear and pinch wheel, described in the next section.

Mounting the track motor gear and pinch wheel



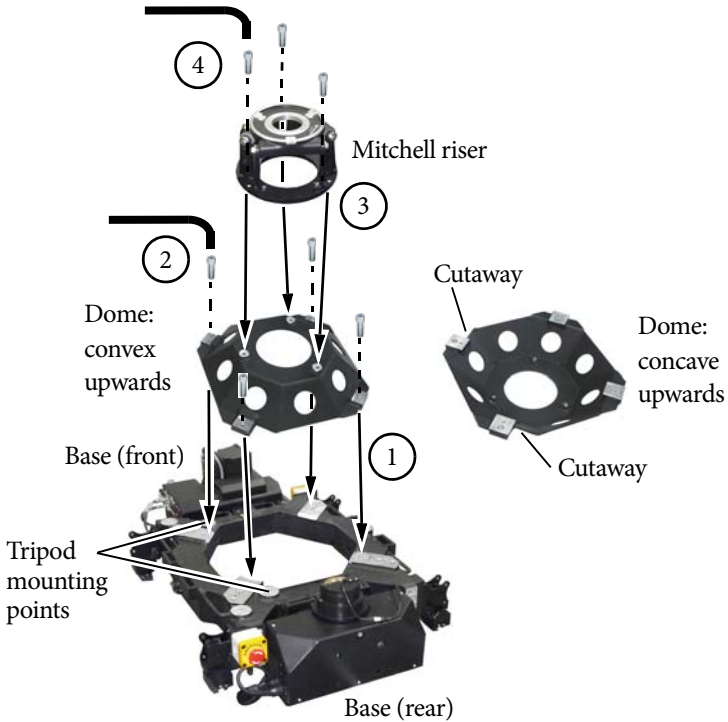
1. Turn the handwheel to loosen the track motor clamp.
2. Mount the track motor assembly onto the Modula base by inserting the track motor mounting bar into the track motor clamp.
3. Turn the handwheel to tighten the track motor clamp.
4. Remove the hinge bolt from the track motor assembly (if that's where the bolt is stored) or get the hinge bolt from the pinch wheel tool kit.
5. Insert the hinge bolt into the underside of the pinch wheel assembly.
6. Insert the hinge bolt into the track motor assembly, and tighten. There is a row of threaded holes in the track motor assembly; use whichever hole is suitable. Make sure the other end of the pinch wheel assembly fits between the pinch wheel adjustment bolt and the rack; you might have to loosen the pinch wheel adjustment bolt to do this.

- Hand-tighten the pinch wheel adjustment bolt so that the rubber pinch wheel presses firmly against the smooth side of the rack. This holds the track motor gear firmly against the toothed side of the rack.



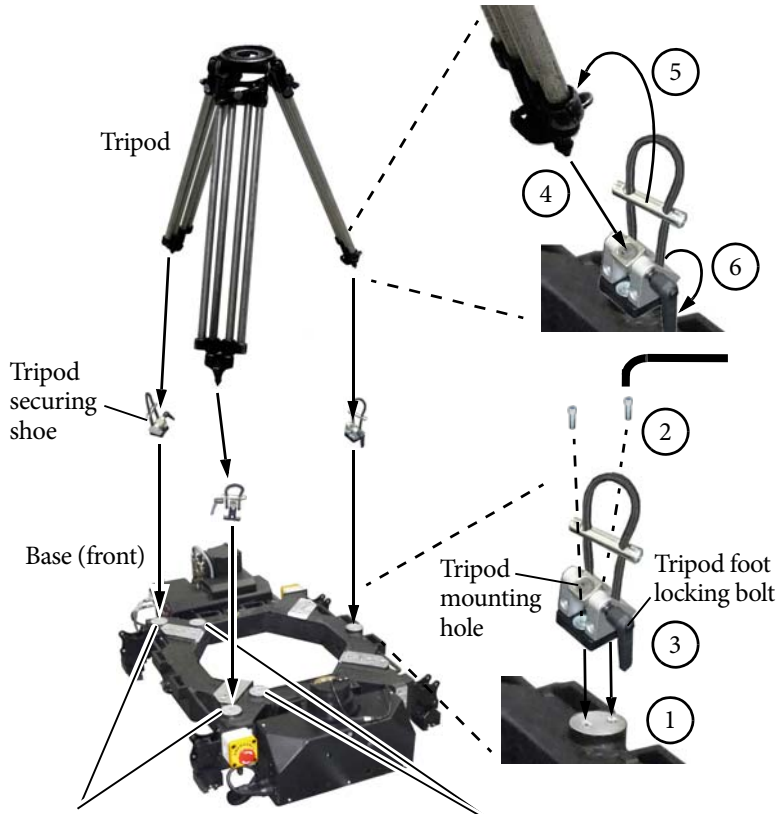
- Connect the two cables for the track motor. Note that the motor itself might be mounted on the drive unit in an orientation other than that shown in the picture.
- The pinch wheel assembly has sensors for detecting the Limit (L) and Datum (D) magnets on the track. Connect the cables for these sensors to the **LIMITS** connector on the junction box on the Modula base.
- Attach cable ties to hold all cables securely up away from the track.

Mounting the dome and Mitchell riser onto the base



1. Lower the dome onto the base. You can mount the dome either way up depending on the camera height you want, as there is enough clearance between the Modula base and MRMC heads to allow full rotation of the head in either orientation. Orient the dome so that the two cutaways leave the tripod mounting points exposed, in case you want to use a tripod later without removing the dome.
2. Insert the four bolts that hold the dome onto the base, and tighten.
3. Mount the Mitchell riser onto the dome, aligning the three holes.
4. Insert the three Mitchell riser mounting bolts, and tighten.

Mounting a tripod onto the base



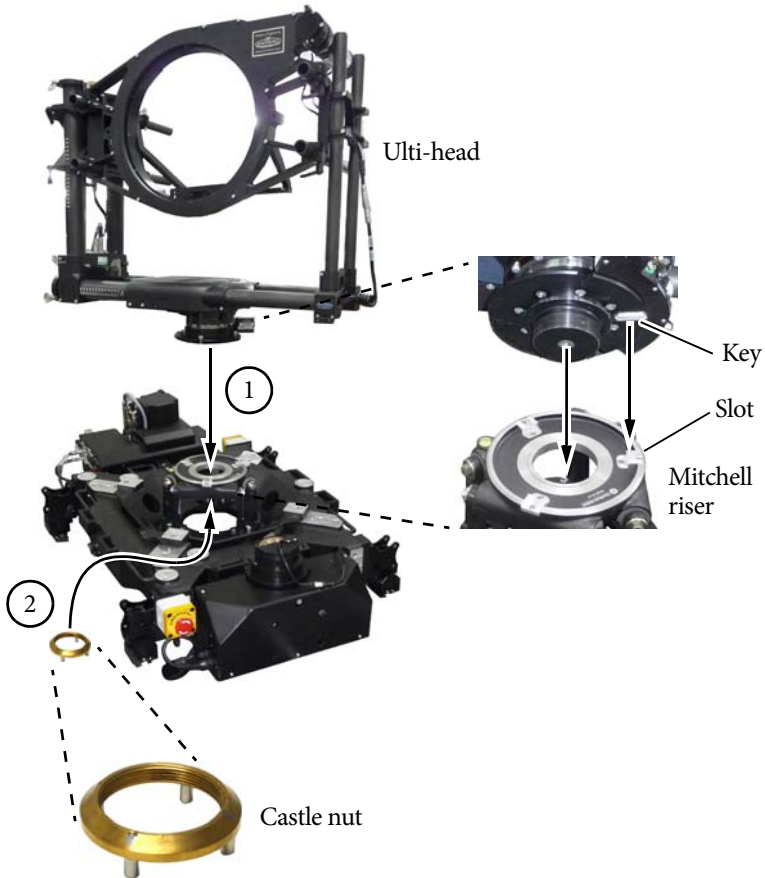
The mount points near the edge give a wider footprint for maximum stability

The mount points near the centre put the centre of the tripod over the centre of the base.

1. Put the tripod securing shoes onto the tripod mounting points on the base, with the tripod mounting holes facing the centre of the base and the straps on the outside.
2. On each shoe, insert the two retaining bolts, and tighten.
3. On each shoe, loosen the tripod foot locking bolt.
4. Put the three tripod legs into the holes in the tripod securing shoes.
5. On each shoe, pull the metal bar up and over the tripod foot tab.
6. Tighten the tripod foot locking bolt.

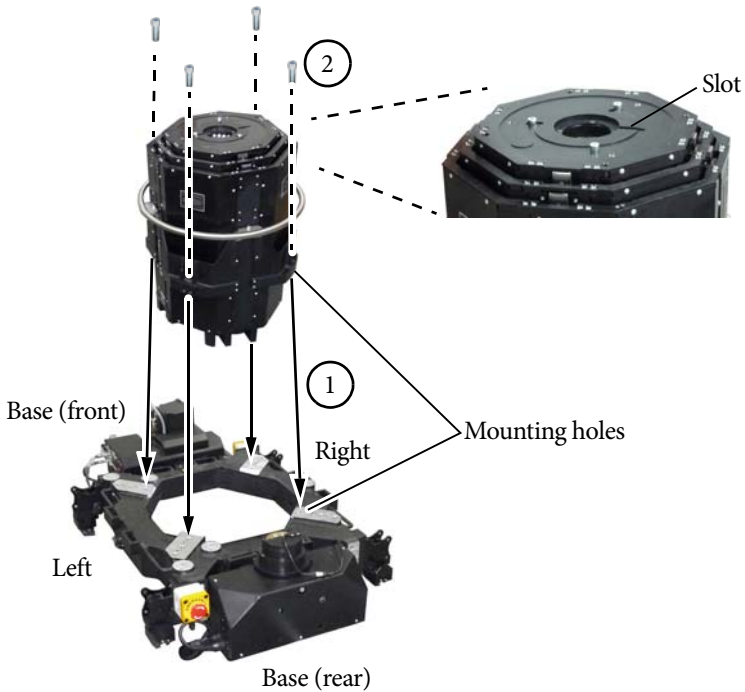
Mounting an Ulti-head onto a Mitchell plate

You can mount an Ulti-head onto any device that has a Mitchell plate, such as a Mitchell riser or Ronford Baker tripod. The picture shows a Mitchell riser mounted on an inverted dome, but the Mitchell riser could also be mounted on a lift column or turret.



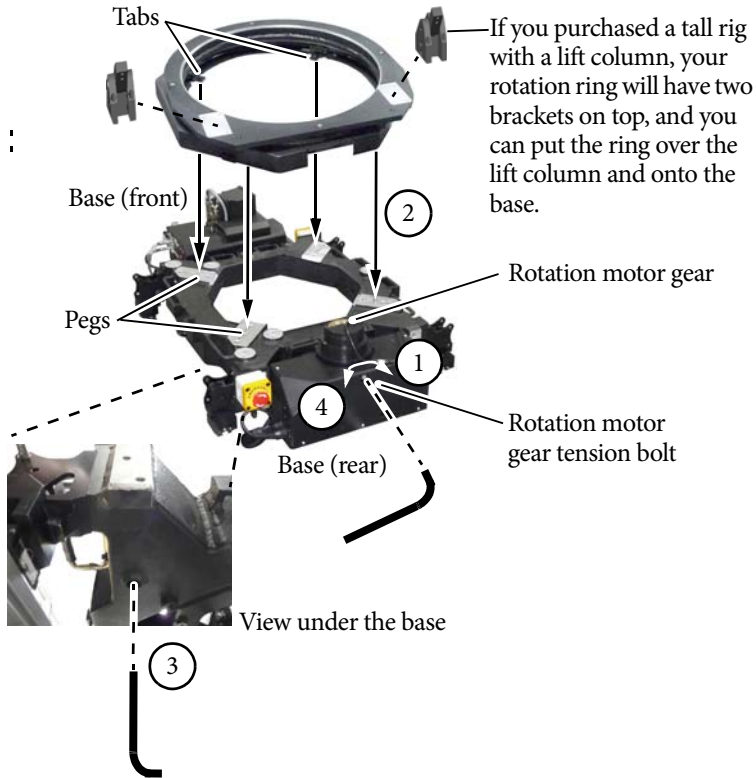
1. Mount the Ulti-head onto the Mitchell riser, making sure that the key in the head fits into one of the slots in the Mitchell riser.
2. Secure the Ulti-head by screwing the castle nut onto the Ulti-head base from underneath. Tighten it firmly.

Mounting the lift column onto the base

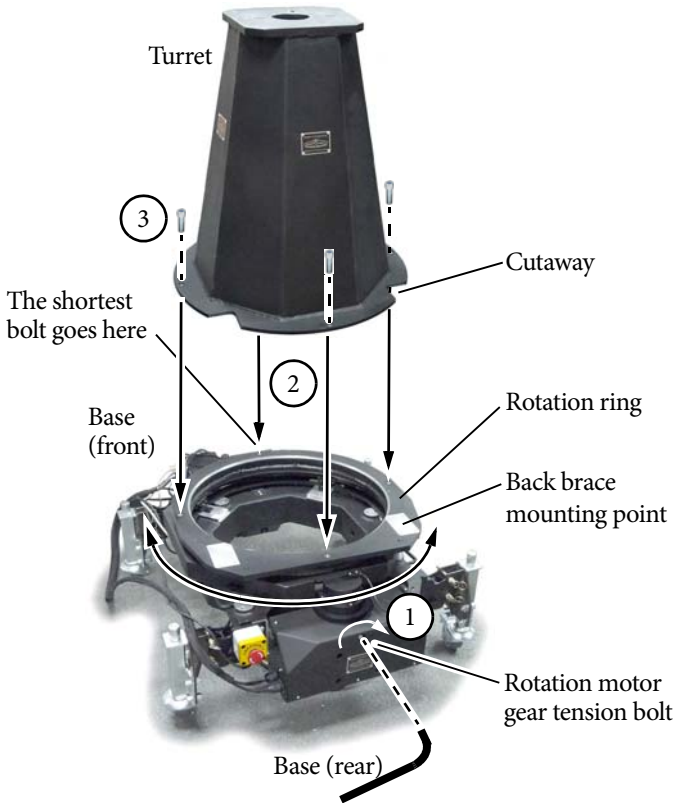


1. Lower the lift column into the centre of the base until the lift column rests on its four corners, with the mounting holes of the lift column lined up with the mounting holes in the base. Although the orientation is not important, you typically orient the lift column to put the slot for the head on the right-hand side of the rig.
2. Insert the four retaining bolts through the corners of the lift column and into the base, and tighten.

Mounting the rotation ring onto the base



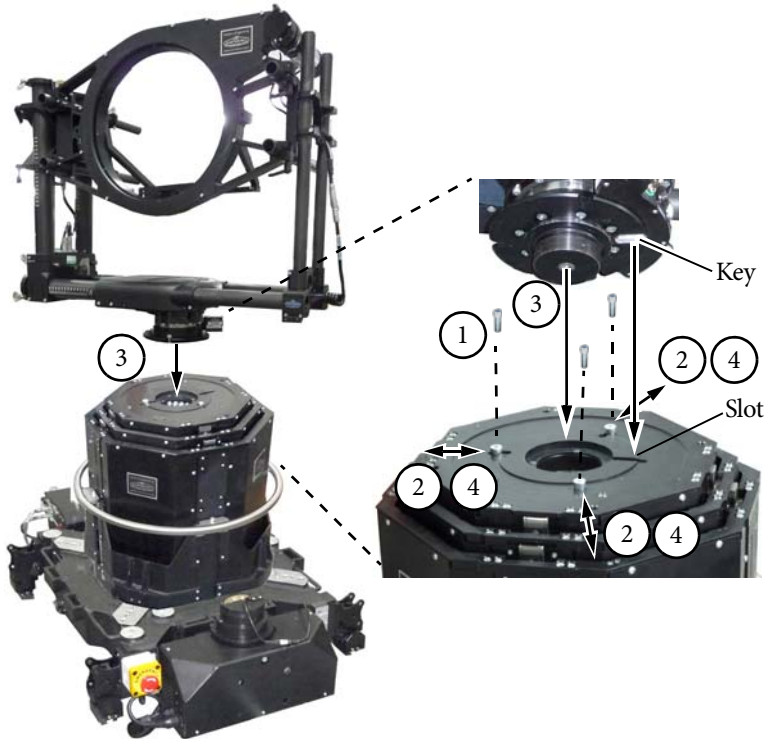
Mounting the turret onto the rotation ring



1. Rotate the rotation ring on the base to the orientation shown. To do this you might need to disengage the rotation motor gear by tightening the tension bolt. After rotating the ring, loosen the tension bolt to re-engage the rotation motor gear.
2. Lower the turret onto the rotation ring on the base, making sure that the two cutaways in the turret leave the two back brace mounting points on the rotation ring exposed. Line up the holes in the bottom of the turret with the holes in the rotation ring.
3. Insert and tighten the four bolts that hold the turret onto the rotation ring, making sure that you use the shortest bolt at the front of the rotation ring.

Mounting an Ulti-head directly onto the lift column or turret

The picture shows a lift column but the procedure is the same for a turret.

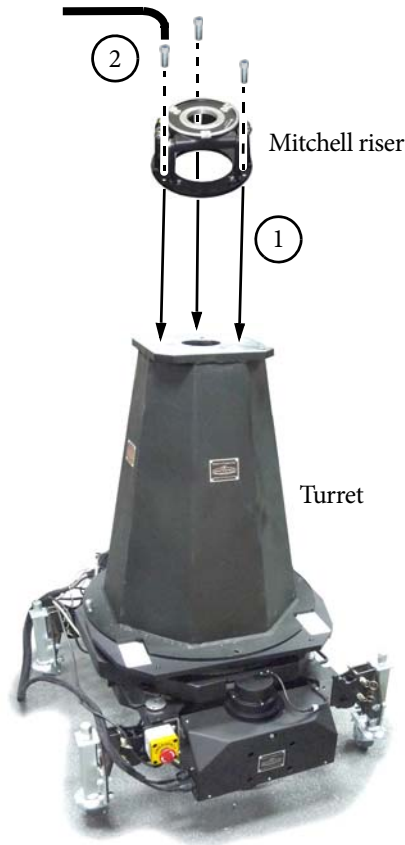


1. Insert the three retaining bolts into the captive nuts in the top of the lift column or turret. These nuts are in slotted compartments that allow them to move. **Keep the bolts very loose for now.**
2. Slide the retaining bolts, along with their nuts, away from the centre and toward the outer edge of the lift column.
3. Lower the Ulti-head onto the top of the lift column or turret, making sure that the key on the head fits into the slot in the lift column or turret.
4. Slide the retaining bolts back toward the centre and into the slots in the Ulti-head base plate, as far as they will go, so that the bolt tops (caps) grip the Ulti-head base plate, then tighten.

Mounting the Mitchell riser onto the lift column or turret

Using a Mitchell riser gives you extra height for the head. On a turret a Mitchell riser also allows you to run cables under the head, through the middle of the turret, to the Modula base. On a lift column you must run the cables outside the lift column; do not run cables through the middle of the lift column.

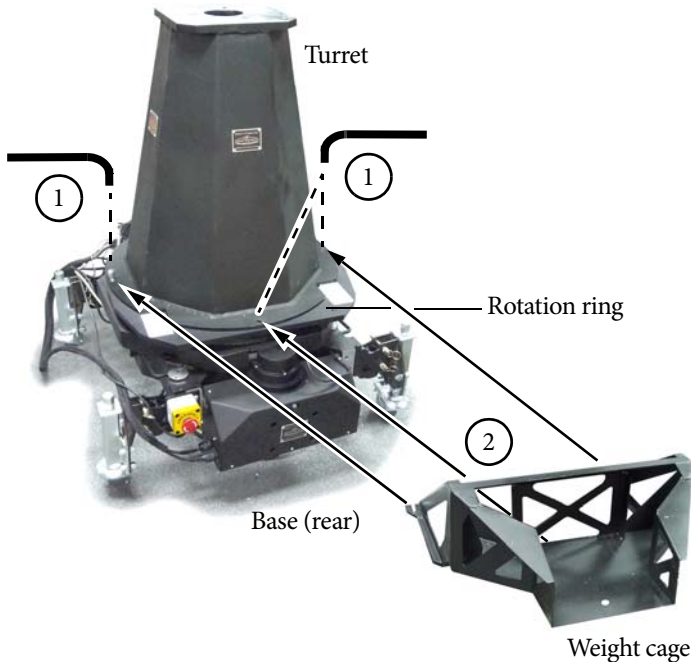
The picture shows a turret but the procedure is the same for a lift column.



1. Mount the Mitchell riser onto the lift column or turret, aligning the three holes.
2. Insert the three Mitchell riser mounting bolts, and tighten.

Mounting the weight cage onto the rotation ring

You need to use counterweights if you are going to use the main arm mounted on top of a lift column or turret. The amount of weights needed depends on the weight of the camera to be used. For a turret-based rig you mount the weight cage over the turret on the rotation ring. For a lift-column-based rig you use the same mounting points to mount the weight cage directly onto the rotation ring and you can mount the weight cage at any time after you have mounted rotation ring.



1. For a turret-based rig, loosen three of the four bolts that hold the turret on the rotation ring. Leave the fourth bolt (at the front of the rotation ring) tight.

For a lift-column-based rig, insert three bolts into the rotation ring in the positions shown but do not tighten them yet.

For both rig types, leave enough bolt showing to accommodate the weight cage that fits onto these bolts in the next step.

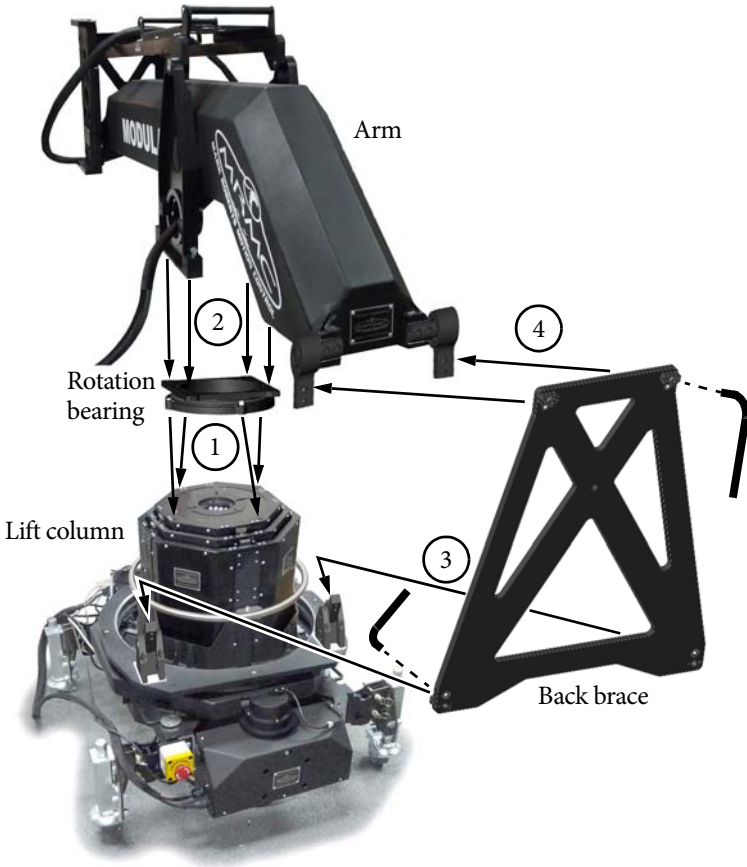
2. Mount the weight cage onto the rotation ring, over the turret if applicable, by fitting the weight cage slots around the three bolts shown.
3. Tighten the three bolts.

Side view



4. Add weights to the weight cage. The Modula arm typically requires four weights, depending on the weight of the head and the camera used. The weights are 13 Kg each.
5. Secure the weights in place with the retaining bolt and nut.

Mounting the arm onto the lift column



1. Mount the rotation bearing onto the top of the lift column and tighten the four retaining bolts.
2. Mount the arm onto the rotation bearing and tighten the four retaining bolts.
3. Mount the bottom of the back brace onto the brackets on the rotation ring, and tighten the retaining bolts. Put the brace the right way around, so you tighten the bolts from the Lift column side.
4. Adjust the tilt of the arm and tilt in the top of the back brace to mate with the brackets on the rear end of the arm, and tighten the retaining bolts.

Mounting the arm onto the turret

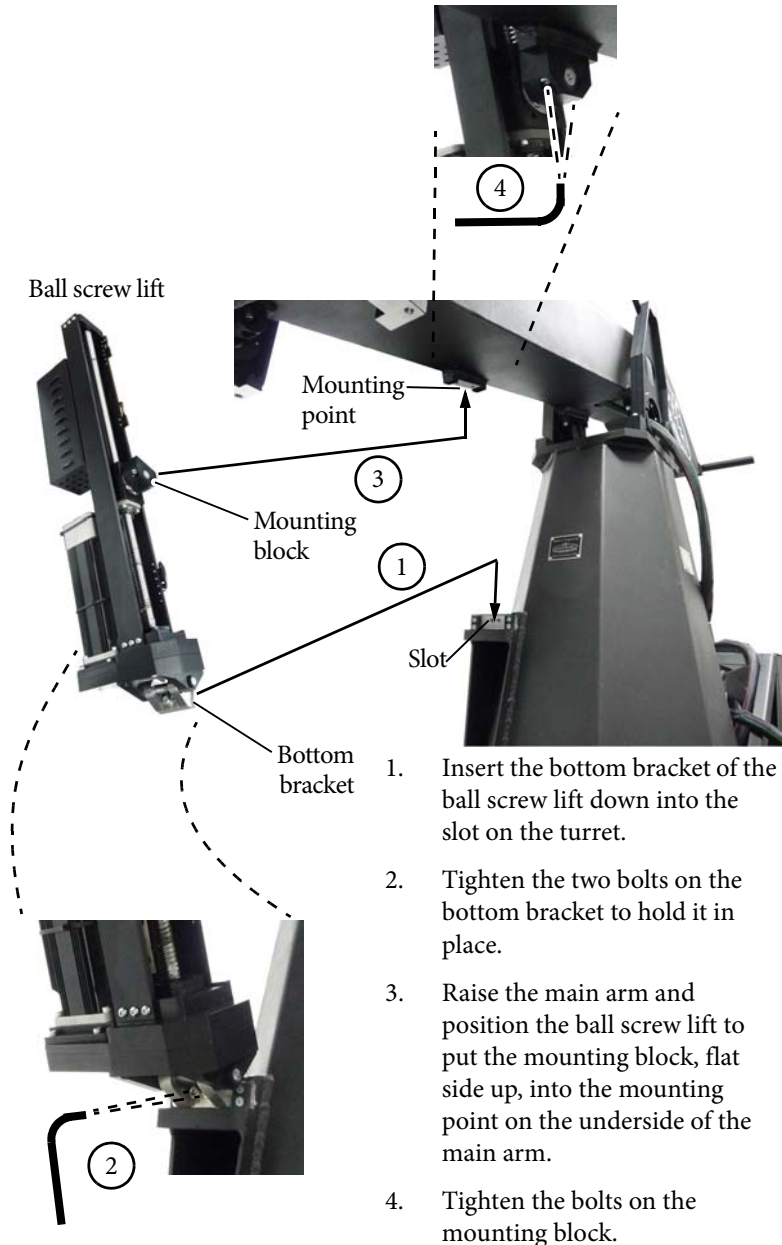
Hint

It is useful to have a movable table that you can use to hold up the camera end of the main arm while you tighten the bolts onto the turret.



- ◆ Lower the arm onto the turret and tighten the four retaining bolts.

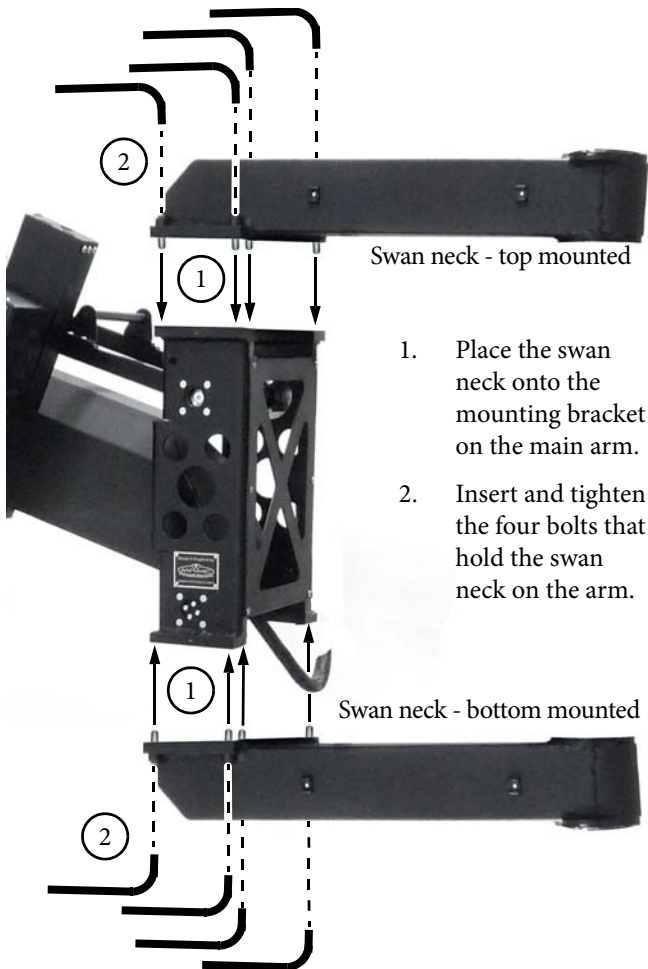
Mounting the ball screw lift onto the turret



Mounting the swan neck onto the arm

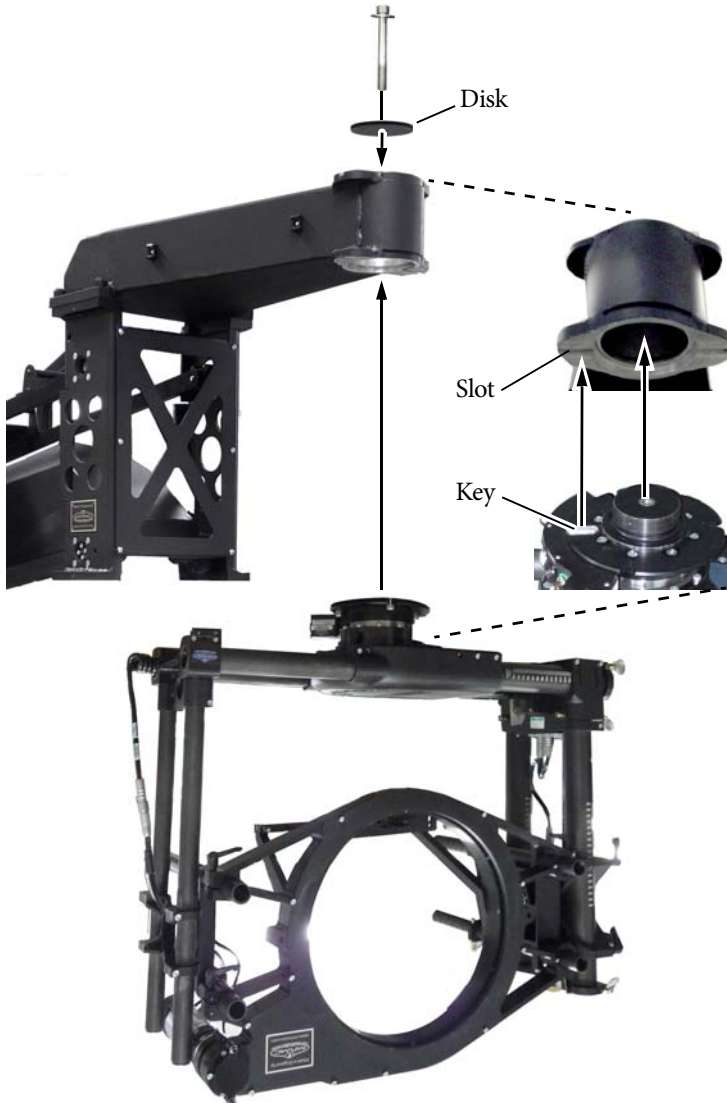
Hint

You can mount the swan neck onto the top or bottom of the main arm bracket. In either position you can then mount the head on top of the swan neck (overslung) or under the swan neck (underslung), giving you a total of four possible camera height ranges.



Mounting an Ulti-head onto the swan neck

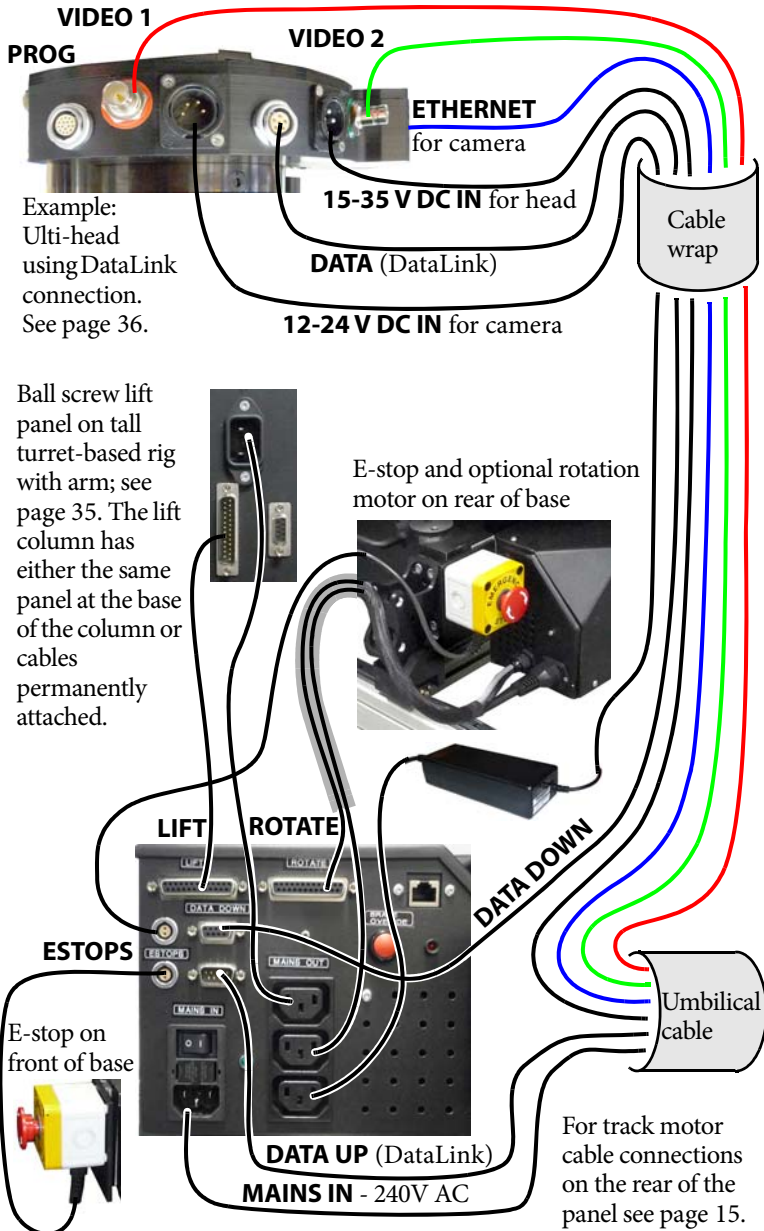
You can mount the head under-slung as shown or over-slung.

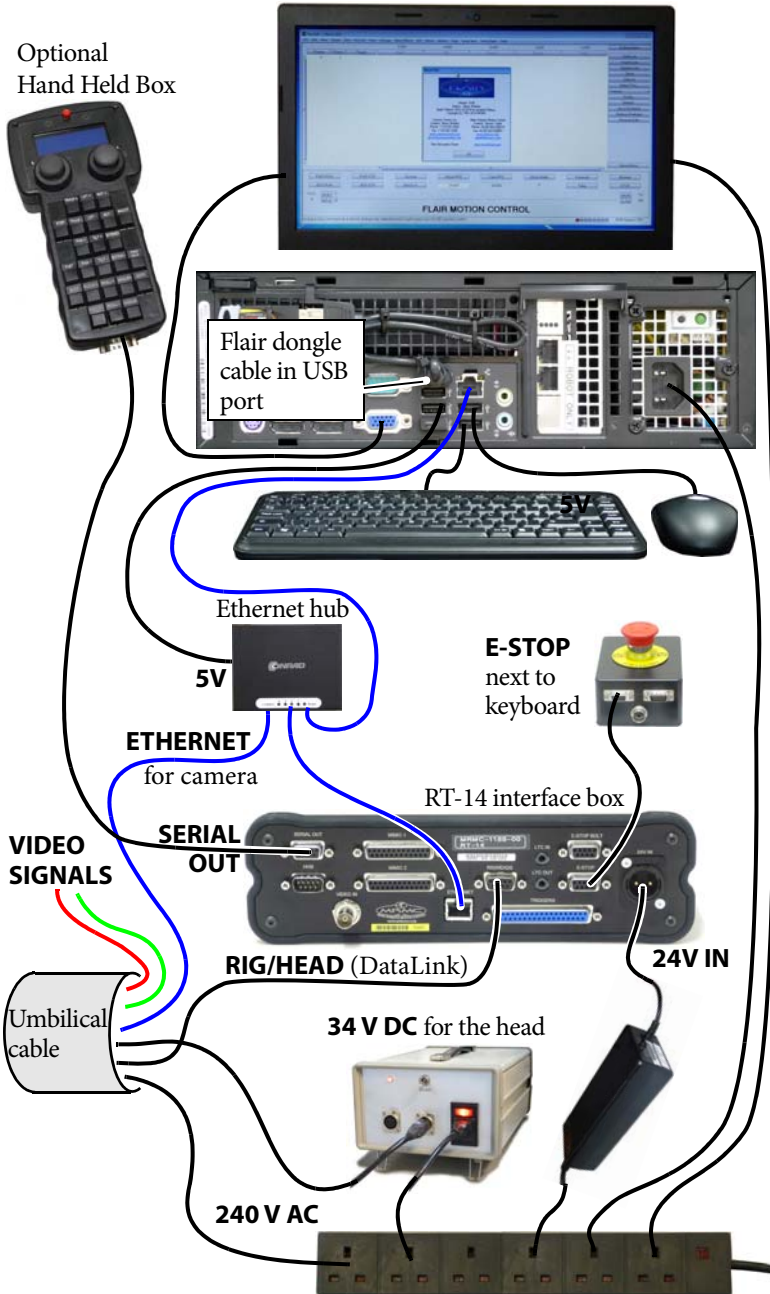


- ◆ Mount the head to the swan neck with the single bolt and disk, making sure that the key on the head fits into the slot in the neck.

Notes

Connecting the cables





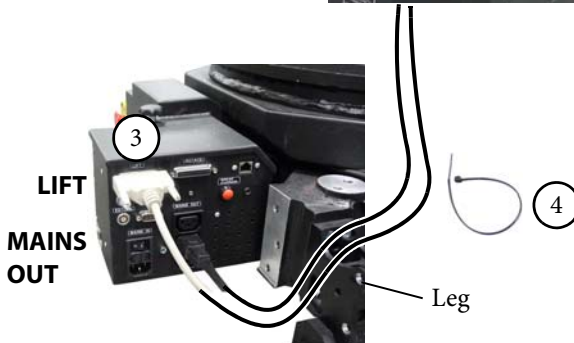
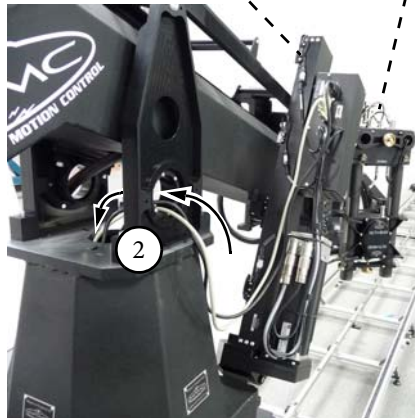
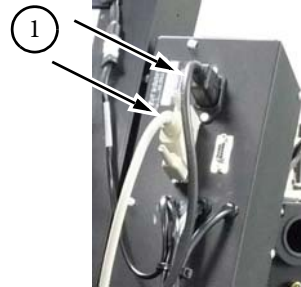
Picture of Modula panel showing Lift, Rotate, and E-Stop connections:



Ball screw lift connections

You use these connections if you are using a tall turret-based rig with a lift arm.

1. On the ball screw lift, plug in the 25-way control cable and 3-way power cable.
2. Feed the other ends of the cables through the arm mount and down through the middle of the turret, leaving plenty slack at the top.
3. Pull the cable ends out from under the turret and base, over the leg, and plug them into the **LIFT** and **MAINS OUT** connectors on the main Modula panel.
4. Use cable ties to tie the cables up against the base (away from the track) and against the top of the turret, allowing enough slack hanging inside the turret for rotation and hanging outside the turret for lift.

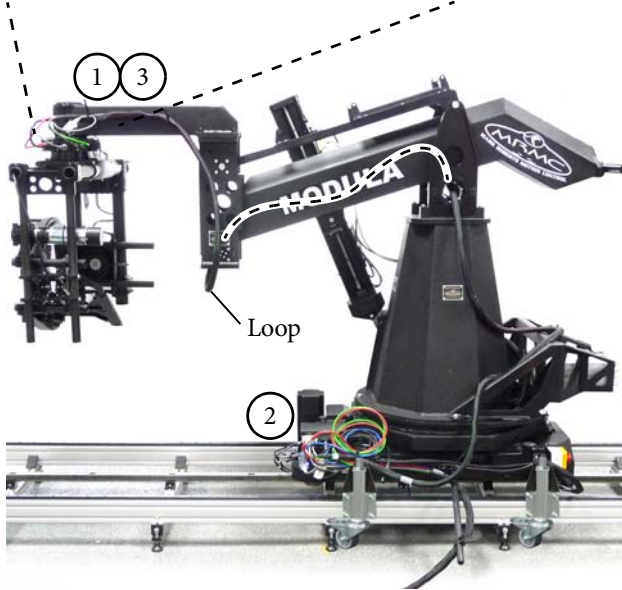


Head connections

This example shows a tall turret-base rig with an arm but applies to any Modula rig. The only difference is the path of the cables.



Example head: Ulti-head



1. If you are using a tall rig with an arm, use cable ties on the swan neck to loosely attach the cluster of cables for the head. Leave enough slack in the ties for now to allow adjustment of the cable length.
2. Attach the connectors to the head and camera as required. See page 32.

3. If you are using a tall rig with an arm, tighten the cable ties on the swan neck, leaving enough cable under the arm to form a short free-hanging loop to avoid subjecting the cable to any tension or sharp flexing during use.
4. Attach the other end of the head cables as required. See page 32.

Cable connection notes

To run the rig you must choose the same connection method for both Modula and head; that is, either DataLink or Ethernet. The previous diagram shows DataLink. Although the Ulti-head has a **PROG**/Serial connector, the Serial connection method is not used on the Modula.

On the Ulti-box (on the camera side of the slip ring) when you use one of the **DATA** or **ETHERNET** connectors, the other connector and the **PROG** connector must be empty.

If you are using a DataLink connection method, you can still use a separate Ethernet cable for the camera if you want (going through the slip ring) as long as the Ethernet cable is not connected to the Ulti-box.

Hint

All connections that go through the Ulti-head slip ring are straight-through connections that do not affect the head until you connect them to the Ulti-box on the camera side of the slip ring.

Although the Ulti-head can run on power as low as 12 Volts DC, to get more speed you typically use a 34-48 Volt DC power supply off the rig and send the 34-48 Volt DC voltage through the umbilical cable to the head.

When you have connected all the cables, use cable ties to secure them away from moving parts so they don't get caught when you operate the rig. Tie the umbilical cable onto the cable guide arm on the Modula base (described on page 13) to keep the umbilical cable from catching on the track when the rig is in motion.

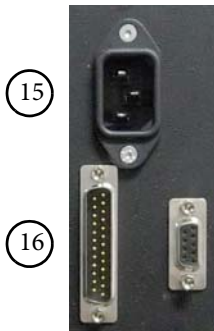
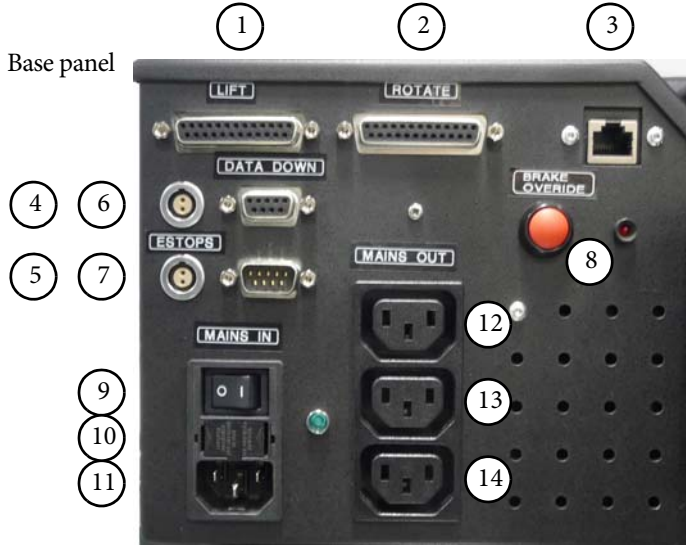
Specifying the new hardware configuration in Flair

Changes to the Modula hardware configuration require changes to the configuration of the Flair Motion Control Software running on your PC, which controls the Modula. The required changes include the number of axis boards, the axes configuration, and the kinematics model settings. These can get complicated, and it is recommended that you contact Mark Roberts Motion Controls for advice. You can also refer to the separate *Flair Operator's Manual*.

Notes



Appendix 1 Modula panels

Panel summary



Panel on the lift column and ball screw lift.

1. **LIFT** axis connector, for a lift column (used on a tall lift-column-based rig with or without an arm) or a ball screw lift (used on a tall turret-based rig with an arm). For pin-out information see *Axis connector* on page 43.
2. **ROTATE** axis connector, for the rotation motor that moves the rotation ring. For pin-out information see *Axis connector* on page 43.

3. **ETHERNET** RJ45 connector, for connection to an Ethernet hub as part of a multi-component system, as an alternative to using a DataLink connection. This Ethernet port is rated at 100 Mbits/sec but can operate at lower speeds of 10 Mbits/sec or less.
- 4, 5. **ESTOPS** connectors, for the E-Stop buttons on the Modula base. For pin-out information see *E-Stop connector* on page 45.
6. **DATA DOWN** DataLink Out (Down Link) connector, for connection to a head using a DataLink connection, as an alternative to using an Ethernet connection. For pin-out information see *Data Down connector* on page 44.
7. **DATA UP** DataLink In (Up Link) connector, for controlling the Modula (track motor, rotation ring, and lift) using a DataLink connection, as an alternative to using an Ethernet connection. You connect this to the **RIG/HEAD** connector on an RT-12 or RT-14 interface box, which in turn is connected to a PC running Flair Motion Control software via an Ethernet connection. For pin-out information see *Data Up connector* on page 44.
8. **BRAKE OVERRIDE** and indicator light, for releasing the Track brake on the Modula base so you can push the Modula along the Track by hand. This leaves the Track encoder active and still being read by Flair, so you can still record the Track move with Flair's Learn facility if you want. To use the override facility, disengage the Track in Flair and then press the **BRAKE OVERRIDE** button on the Modula base **once**. The indicator light on the Modula base shows that the brake has been released. You can then push the Modula along the Track by hand, and optionally record the move in Flair. To resume normal mode, re-engage the Track in Flair. If you have switched other parts of the rig or Flair software on or off in the meantime, you might need to reload the Track axis board and disengage and re-engage the Track again in Flair to resume normal mode.
9. **MAINS SWITCH**, and indicator light. You should only turn on the Modula when all mechanical parts are securely mounted in place and all cables are connected.
10. **FUSE** cover. There are two fuses, each with a rating of 10 Amps.
11. **MAINS IN** power input connector, 240V AC, for the Modula (track, rotation, lift) and the attached head and camera.

- 12, 13, 14. **MAINS OUT** connectors, 240V AC, for powering the lift, rotate, and transformer for the camera. For pin-out information see *Mains Out connector* on page 46. In order to get the best performance from the Ulti-Head, most Modula users power the head by using a separate dedicated 36 Volt DC power source off the rig, with the 36 Volt DC power cable running through the umbilical cable cluster between the computer stack and the rig.
15. **MAINS IN** power input connector, 240V AC, on the lift column and ball screw lift. For pin-out information see *Mains In connector* on page 45.
16. **Axis** connector on the lift column and ball screw lift, 25-pin. For pin-out information see *Axis connector* on page 43.
17. **Service** connector (9-pin) for programming the motors in the lift column or ball screw lift. This is only used by MRMC service personnel. For pin-out information see *Service connector* on page 46.

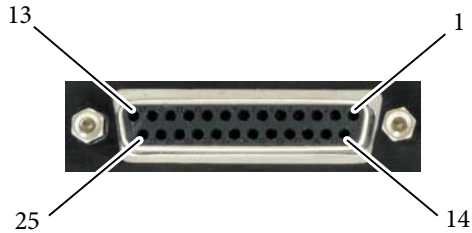
Connector pin-out information

Axis connector

This 25-pin connector is used for the Modula's Lift and Rotate axes.

1. ENCA-
2. ENCB-
3. ENCZ-
4. GND
5. N/C
6. LIM1
7. +5V
8. (BRK)
9. ENABLE
10. +24V
11. +24V
12. STEP
13. DIR
14. ENCA+
15. ENCB+
16. ENCZ+
17. +5V
18. GND
19. DATUM
20. SW24
21. FAN+
22. FAN-
23. N/C
24. ANALOG OUT -
25. ANALOG OUT +

Female version on the Modula base panel:



Male version on the lift column and ball screw lift:



Notes:

SW 24 --> +24V

- The E-stop controls this 24V output:
E-stop pressed: no output.
E-stop released: 24V output

BRK

- The brake signal coming from an Axis card.

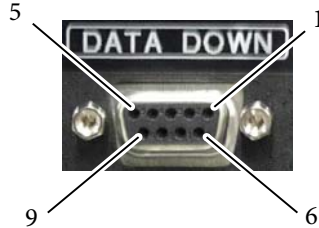
FAN+, FAN-

- This was connected to an internal fan in previous versions but is no longer used. Bridging FAN+ and FAN- turned on the internal fan, but in the current version the fan is on all the time.

Data Down connector

This is a DataLink Out connector. For usage see page 41.

1. Watchdog-
2. Out-
3. In-
4. ESTOP
5. N/C
6. Watchdog+
7. Out+
8. In+
9. ESTOP

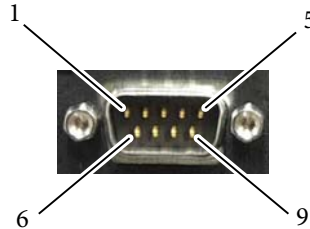


Pins 4 and 9 are for the Emergency Stop (E-stop). The polarity doesn't matter. The E-stop loop runs through all units on the DataLink chain. A break at any point will stop the entire rig.

Data Up connector

This is a DataLink In connector. For usage see page 41.

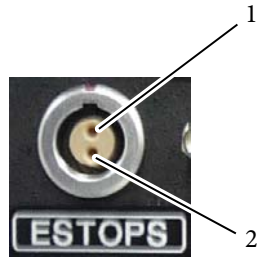
1. Watchdog-
2. In-
3. Out-
4. ESTOP
5. N/C
6. Watchdog+
7. In+
8. Out+
9. ESTOP



Pins 4 and 9 are for the Emergency Stop (E-stop). The polarity doesn't matter. The E-stop loop runs through all units on the DataLink chain. A break at any point will stop the entire rig.

E-Stop connector

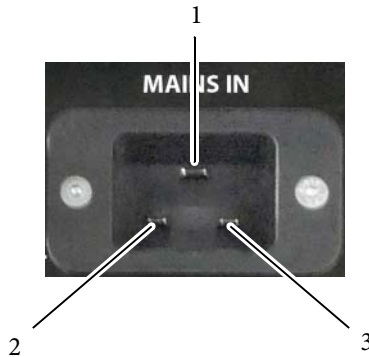
The **ESTOP** connector is a two-pin female connector, to which you attach the dedicated external E-stop buttons. The polarity does not matter, so there are no specific pin-out allocations. The rig will not operate without the E-stop buttons attached, as they complete the E-stop circuit loop and allow the rig to run. Breaking the circuit loop at any point (for example by depressing an E-stop button) invokes the E-stop for the entire rig.



Mains In connector

Power input connector for the Modula and its attachments. 240 Volts AC.

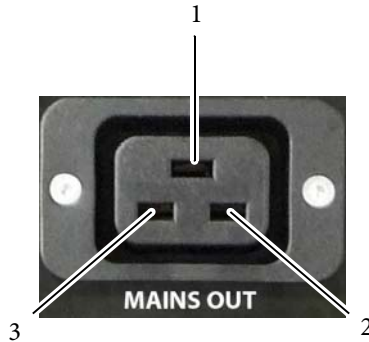
1. Earth
2. Live
3. Neutral



Mains Out connector

Power output, usually connected to the Mains In connector on the Modula turret to power the ball screw lift and camera. 240V AC.

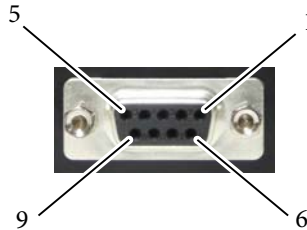
1. Earth
2. Live
3. Neutral



Service connector










This is a 9-pin connector used to program the motors in the lift column or ball screw lift. It is only used by MRMC service and support personnel.





1. A+
2. B+
3. N/C
4. N/C
5. +5V
6. A-
7. B-
8. N/C
9. GND



Appendix 2 Specifications

Weights of components:

	Item	Weight (Kg)
	Base, with track and rotation motors	34
	Rotation ring	18
	Dome	3
	Mitchell riser	2
	Lift column	60
	Turret	15
	Ball screw lift	20
	Back brace and rotation bearing, total	6
	Arm, without swan neck	20

	Item	Weight (Kg)
	Swan neck	5
	Counterweight cage	10
	Weights, each	13
	Complete turret-based rig with arm, 4 weights, cables, and wheels, without head (approximate)	200

Payload (camera + head): 40 Kg

Power requirements: Single phase 110-240V AC 50-60Hz (earthed/grounded). 110 Volts will push the Modula at half speed.

Temperature range: 0-45 °C (32-113 °F)

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

Dimensions:

Length (base only): 700 mm

Length (base with track motor and rotation motor): 1022 mm

Width (base without wheels): 680 mm

Width (base with wheels) 900 mm

Height: variable, depending on configuration

Note

Note

Note



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