

# Equator™ gauging system



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# Safety

## Equator 300 safety information

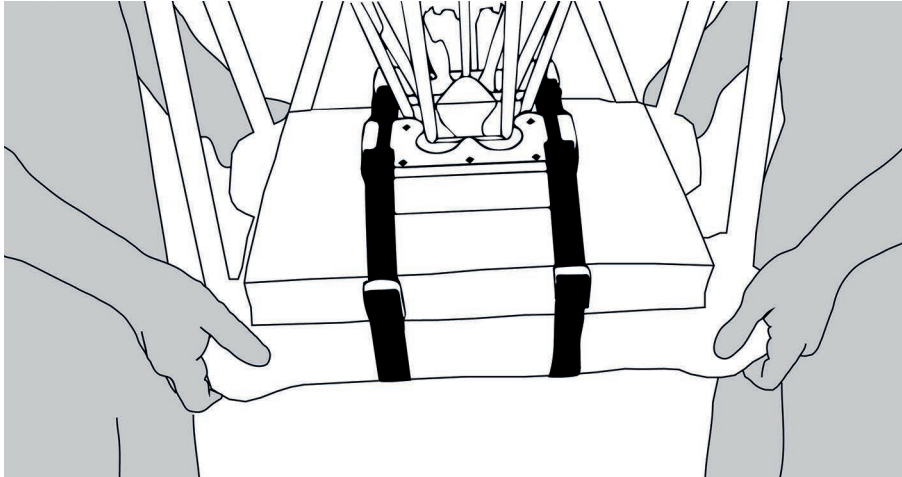


1. Base casting with hand hold locations
2. SP25 probe assembly
3. Floating or moving platform
4. Support strut
5. Top casting
6. Drive strut
7. Counterbalance mechanism

8. Upper pivot / Hooke's joint
9. Support arm for parallel constraint mechanism
10. CE marking and serial number
11. Drive housing
12. Parallel constraint mechanism
13. Fixture plate
14. Workpiece and fixture
15. Stop button and Button Interface, when fitted



- Lifting or moving the Equator should only be attempted by two people, using the hand hold locations provided in the base casting (1).
- Do not move or lift the machine by the top casting (5), the support arms of the constraint mechanism (9), the support legs (4), or the three drive struts (e.g. by holding the orange protectors or any part of the drive strut mechanism) (6).



- Potential finger traps and pinch points exist between:
  - support arm (9) and casting (5);
  - support arm (9) and constraint mechanism (12);
  - upper pivot (8) and drive strut (6);
  - platform (3) and piece part (14);
  - platform (3) and constraint mechanism (12);
  - the struts of the constraint mechanisms (12) in the centre.

Users should not touch the Equator in these locations.

- To warn users of potential risks involved with moving parts, active parts are coloured bright orange (3), (6), (7), (9).
- When the stop button is engaged, hold mode is activated and the machine status light on the floating platform flashes amber. In hold mode, a slow, servo assisted movement of the platform will be allowed. The probe should be held close to the platform to reposition in the desired direction. The module and stylus should not be used to move the platform.
- When connecting a joystick, stop button or Button Interface (15) to the Equator, it must be disconnected from the mains power supply. Not doing so can cause damage to the circuitry.
- Never keep an additional non-connected joystick, stop button or Button Interface (15) in the vicinity of the system to avoid user confusion.
- It is prohibited for the user to enter the working volume during automatic operations. The operator is instructed not to have their hand, or any other part of their body, in the machine during operation.

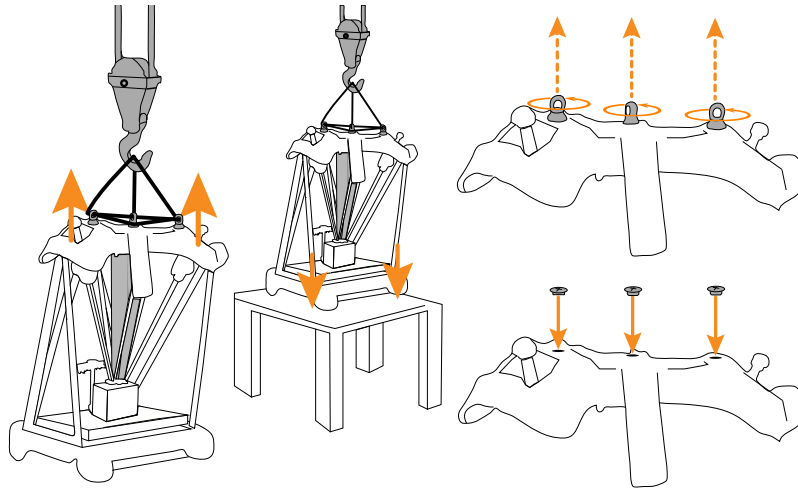
- During homing, the machine is in automatic mode and will only halt if the physical stop button (15) is engaged.
- To avoid unexpected movements of the Equator, always recalibrate all probing tools after importing a new environment.
- On systems already fitted with the SP25 probe (2), the SP25 body contains high power LEDs which emit invisible infrared radiation. The user cannot be exposed to this radiation unless the probe is mechanically damaged. Please refer to the SP25 Installation and Integration Guide, H-1000-7541.
- If this equipment is not used in its intended manner, any protection provided may be impaired and the warranty may be voided.
- CE mark and serial number (10) are located underneath the front support arm for the constraint mechanism (9).

## Equator 500 safety information



- |  |   |
|--|---|
| 1. Base casting                                  | 10. CE marking and serial number                  |
| 2. SP25 probe assembly                           | 11. Drive housing                                 |
| 3. Floating or moving platform                   | 12. Parallel constraint mechanism                 |
| 4. Support strut                                 | 13. Fixture plate                                 |
| 5. Top casting                                   | 14. Workpiece and fixture                         |
| 6. Drive strut                                   | 15. Stop button and Button Interface, when fitted |
| 7. Counterbalance mechanism                      | 16. Blanking cap / eye bolt                       |
| 8. Upper pivot and alignment bracket             | 17. Equator Autojoint Adapter (EQ-AA1)            |
| 9. Support arm for parallel constraint mechanism |   |

- The weight of the Equator 500 unpacked is 74 kg and therefore it is advised that the machine is only lifted using mechanical means. A high lift pallet truck can be used under the machine base, or a lifting arm can be used with the supplied eye bolts from the top casting. Once in position, the eye bolts can be removed and the supplied blanking caps inserted.
- If inserting pallet truck forks under the base, be careful of drain pipe and cable clip locations, and ensure that the forks are properly supporting the base, i.e. inserted fully past the casting.



- The Equator 500 should only be mechanically lifted using, for example, a gantry crane, forklift, etc. There are eye bolts (16) on the top casting of the Equator 500 to allow for the use of lifting straps or a harness. Each eye bolt supplied with the Equator 500 has been rated to a safe working load of 240 kg, and manufactured to DIN 850. Renishaw only guarantees the integrity of the eye bolts supplied for the initial installation of the unit. Should you wish to use this equipment for subsequent lifts, it is your responsibility to ensure it is inspected in accordance with local legislative requirements before use.
- Do not move or lift the machine by the support arms for the constraint mechanism (9), the support struts (4), or the three drive struts (6) (for example, by holding the orange protectors or any part of the drive strut mechanism).
- Potential finger traps and pinch points exist between:
  - support arm (9) and casting (5);
  - support arm (9) and constraint mechanism (12);
  - upper pivot (8) and drive strut (6);
  - platform (3) and piece part (14);
  - platform (3) and constraint mechanism (12);
  - the struts of the constraint mechanisms (12) in the centre.

Users should not touch the Equator in these locations.

- To warn users of potential risks involved with moving parts, active parts are coloured bright orange (3), (6), (7), (9).

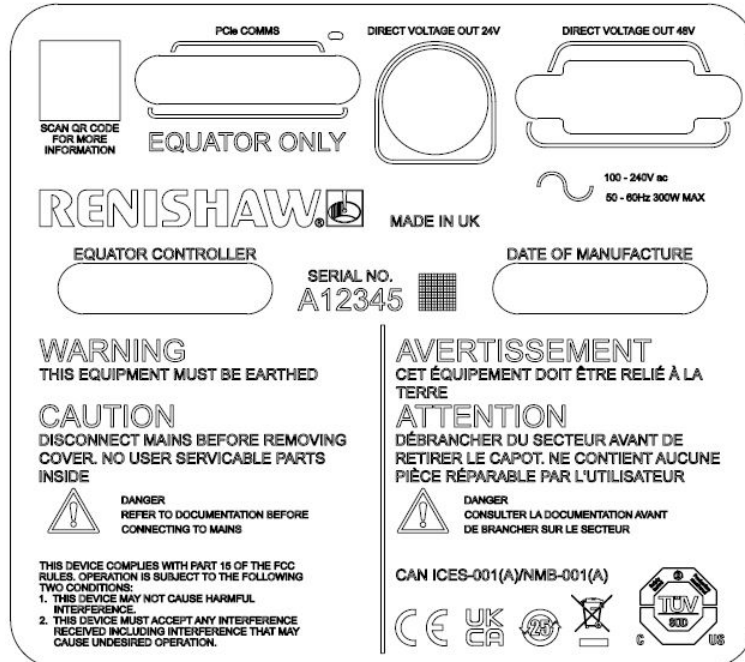
- The EQ500 drive includes a physical brake that will engage if the power to the machine is lost, the stop button is pressed or under certain other error conditions. Do not try to backdrive the platform, as either the brake or the drives will be engaged and damage to the machine may occur. Only move the machine using the joystick, button interface or programmatically.
- When in packaging the brake is not activated so it is possible to move the platform carefully by hand. However upon first power-up, the brake will activate and from that point on, the brake will come on as described above.
- When connecting a joystick, stop button or Button Interface (15) to the Equator, it must be disconnected from the mains power supply. Not doing so can cause damage to the circuitry.
- Never keep an additional non-connected joystick, stop button or Button Interface (15) in the vicinity of the system to avoid user confusion.
- It is prohibited for the user to enter the working volume during automatic operations. The operator is instructed not to have their hand, or any other part of their body, in the machine during operation.
- During homing, the machine is in automatic mode and will only halt if the physical stop button (15) is engaged.
- To avoid unexpected movements of the Equator, always recalibrate all probing tools after importing a new environment.
- When connecting an Equator Autojoint Adapter (17) to the Equator, it must be disconnected from the mains power supply. Not doing so can cause damage to the circuitry.
- On systems already fitted with the SP25 probe (2), the SP25 body contains high power LEDs which emit invisible infrared radiation. The user cannot be exposed to this radiation unless the probe is mechanically damaged. Please refer to the SP25 Installation and Integration Guide, H-1000-7541.
- If this equipment is not used in its intended manner, any protection provided may be impaired and the warranty may be voided.
- CE mark and serial number (10) are located underneath the front support arm for the constraint mechanism (9).

## Equator Controller

- There are no user serviceable parts inside the controller.
- The Equator system must be connected to a supply incorporating a protective earth conductor via a three-core mains cable.
- The equipment is isolated from AC power by disconnection of the IEC mains connector. If any additional means of isolation is required, it must be specified and fitted by the machine manufacturer or the installer of the product. The isolator must be sited within easy reach of the operator and comply with BS EN IEC 61010-1:2010 +AMD1:2016 and any applicable national wiring regulations for the country of installation.
- The Equator Controller can be placed either standing or lying on its side, but should be given a reasonable protection from liquid spillage.
- The fans for cooling the equipment must not be obstructed. Fans are located on the front and back of the controller. Ensure that the Equator Controller fans are located at least 10 cm from any surface.



Where this symbol is displayed on the product, the user must refer to the user guide for information and safety advice



## Personal protective equipment information

- To reduce the risk of injury, the wearing of safety goggles and safety shoes is recommended when working within the vicinity of this machine.\*
- Never lean on any part of the machine, and keep a minimum of 0.5 m clearance zone around the volume of the machine when it is operating.

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**\*NOTE:** Customers should complete their own risk assessment on delivery of the machine to define their own PPE requirements.

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## Regulatory information

### Disclaimer

RENISHAW HAS MADE CONSIDERABLE EFFORTS TO ENSURE THE CONTENT OF THIS DOCUMENT IS CORRECT AT THE DATE OF PUBLICATION BUT MAKES NO WARRANTIES OR REPRESENTATIONS REGARDING THE CONTENT. RENISHAW EXCLUDES LIABILITY, HOWSOEVER ARISING, FOR ANY INACCURACIES IN THIS DOCUMENT.

### Patents

Features of Renishaw's Equator and similar products are the subject of the following patents and patent applications: CNw 100402873C China 0516/CNw/0

- |                                       |   |
|---------------------------------------|---|
| • CNw CN100464084C China 0584/CNw/0   | • JP 3,827,748 Japan 0317/JP/0              |
| • CNw CN1295484C China 0543/CNw/0     | • JPw 4062515 Japan 0495/JPw/0              |
| • EP 0470234 Europe 0187/EP/          | • WO 2009/027660 P.C.T. 0746/WO/0           |
| • EP 0501710 Europe 0243/EP/          | • USw 5,088,209 United States 0115/USw/0    |
| • EP 0543513 Europe 0226/EP/          | • US 5,302,820 United States 0226/US/2      |
| • EP 0564152 Europe 0249/EP/          | • US 5,323,540 United States 0243/US/2      |
| • EP 0674969 Europe 0317/EP/          | • USw 5,327,657 United States 0211/USw/0    |
| • EP 0748436 Europe 0344/EP/          | • US 5,339,535 United States 0243/US/0      |
| • EP 1086352 Europe 0439/EP/          | • US 5,402,981 United States 0249/US/0      |
| • EP 1147377 Europe 0449/EP/          | • USw 5,404,649 United States 0211/USw/2    |
| • EP 1368615 Europe 0495/EP/          | • US 5,505,005 United States 0243/US/3      |
| • EP 1407152 Europe 0516/EP/          | • US 5,813,287 United States 0317/US/2      |
| • EP 1446636 Europe 0543/EP/          | • USw 5,861,953 United States 0344/USw/0    |
| • EP 1505362 Europe 0439/EP/          | • USw 6,051,971 United States 0376/USw/0    |
| • EP 1528355 Europe 0543/EP/          | • US 6,145,405 United States 0317/US/3      |
| • EP 1585903 Europe 0584/EP/          | • US 6,336,375B1 United States 0317/US/4    |
| • EP 1777423 Europe 0516/EP/          | • USw 6,430,833 B1 United States 0439/USw/0 |
| • EP 548328 B Europe 0211/EP/         | • USw 6,588,333 B1 United States 0449/USw/0 |
| • EP 826138 B Europe 0376/EP/         | • US 6,772,527 B1 United States 0590/US/0   |
| • EP TR 2009 02853 T4 Europe 0516/EP/ | • USw 6,909,983 B2 United States 0495/USw/0 |
| • JP 2,510,804 Japan 0243/JP/0        | • USw 7,079,969B2 United States 0543/USw/0  |
| • JPw 2002-541,444 Japan 0439/JPw/0   | • USw 7146741B2 United States 0439/USw/2    |
| • JPw 2003-512,611 Japan 0449/JPw/0   | • USw 7241070 B2 United States 0516/USw/0   |
| • JPw 2004-534,189 Japan 0516/JPw/0   | • US 7568854B2 United States 0516/US/2      |
| • JPw 2005-519277 Japan 0543/JPw/0    |   |
| • JPw 2006-513380 Japan 0584/JPw/0    |   |
| • JPw 3,004,050 Japan 0187/JPw/0      |   |
| • JPw 3,294,269 Japan 0211/JPw/0      |   |
| • JP 3,341,922 Japan 0249/JP/0        |   |
| • JPw 3,676,819 Japan 0376/JPw/0      |   |

### Trade marks

RENISHAW and the probe symbol used in the RENISHAW logo are registered trade marks of Renishaw plc in the United Kingdom and other countries. apply innovation and names and designations of other Renishaw products and technologies are trade marks of Renishaw plc or its subsidiaries.

All other brand names and product names used in this document are trade names, trade marks, or registered trade marks of their respective owners.

### Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier.

Unless otherwise specifically agreed in writing between you and Renishaw, if you purchased the equipment from a Renishaw company the warranty provisions contained in Renishaw's CONDITIONS OF SALE apply. You should consult these conditions in order to find out the details of your warranty but in summary the main exclusions from the warranty are if the equipment has been:

- neglected, mishandled or inappropriately used; or
- modified or altered in any way except with the prior written agreement of Renishaw.

If you purchased the equipment from any other supplier, you should contact them to find out what repairs are covered by their warranty.

## Specifications

This guide contains information on the following Equator™ gauging system models.



Equator™ 300

A-5504-0040



Equator™ 300 Extended Height

A-5504-0050



Equator™ 500

A-6078-0070



Equator™ 500 Extended Height

A-6078-0085

The Equator gauging system comprises the Equator gauging machine, the Equator Controller and the probing system.

The Equator gauging system can be an Operator only system or a Programmable system.

The Operator Equator system includes the following components:

- Equator gauging machine
- Controller
- Monitor
- Keyboard
- Mouse
- Probe system
- EQR-6 stylus autochange rack
- Calibration artefact and styli
- Stop button
- One or more fixture plates (as quantity ordered)
- Operator software

The programmable Equator system includes all of the above as well as the following components:

- Joystick
- Programmer software
- USB dongle (enables programmer software)





**Equator™ 300**



**Equator™ 300 Extended Height**



**Equator™ 500**



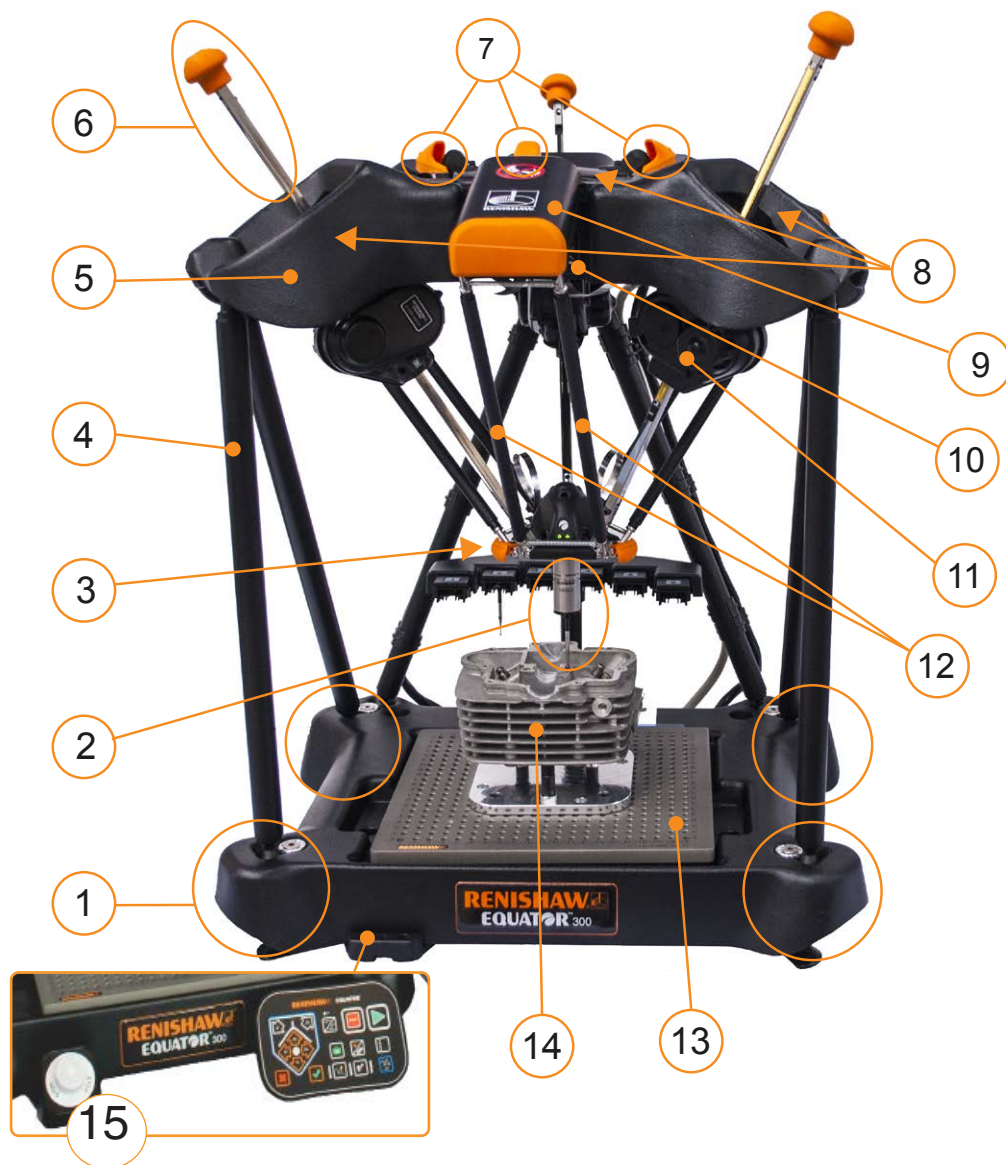
**Equator™ 500 Extended Height**

Machine	Machine Volume (W x D x H) (mm)	Weight (kg)	Working Volume (W x H) (mm)	Fixture Plate (W x D) (mm)	WV height from base* (mm)
Equator 300	570 x 500 x 700	25	300 x 150	305 x 305	1
Equator 300 Extended Height	570 x 500 x 850	27	300 x 150	305 x 305	151
Equator 500	1245 x 1165 x 1545	74	500 x 250	510 x 510	0
Equator 500 Extended Height	1245 x 1165 x 1695	75	500 x 250	510 x 510	150

\*When using a 75 mm x Ø8 mm stylus.

When shorter styli are used, the 'clearance' below the working volume is intended to allow for the use of component holding fixtures, i.e. fixturing can be used without consuming any of the Equator's working volume.

## Equator 300 gauging system specifications



- |  |   |
|--|---|
| 1. Base casting with hand hold locations         | 10. CE marking and serial number                  |
| 2. SP25 probe assembly                           | 11. Drive housing                                 |
| 3. Floating or moving platform                   | 12. Parallel constraint mechanism                 |
| 4. Support strut                                 | 13. Fixture plate                                 |
| 5. Top casting                                   | 14. Workpiece and fixture                         |
| 6. Drive strut                                   | 15. Stop button and Button Interface, when fitted |
| 7. Counterbalance mechanism                      |   |
| 8. Upper pivot / Hooke's joint                   |   |
| 9. Support arm for parallel constraint mechanism |   |



## Equator 300 machine specifications

<b>Comparison uncertainty</b>	± 0.002 mm
<b>Scale resolution</b>	0.0002 mm
<b>Maximum move velocity</b>	500 mm/s
<b>Maximum move acceleration</b>	2500 mm/s <sup>2</sup>
<b>Storage temperature</b>	-25 °C to +70 °C
<b>Operating temperature</b>	+5 °C to +50 °C
<b>Operating humidity</b>	Maximum 80 %RH at 40 °C, non-condensing
<b>Machine electrical supply requirements</b>	24 V DC supplied direct from Equator Controller
<b>Repeatability of piece part in fixture</b>	1 mm
<b>Maximum workpiece weight (including fixture plate)</b>	25 kg
<b>Protective equipment suggested*</b>	Eye protection and safety shoes
<b>Guards</b>	None

The process of measuring on an Equator involves defining a series of gauge points on the component surface. Periodic calibration of a master part on a CMM establishes datum values for each gauge point. The same gauge points on the same master part are measured on Equator (known as 'mastering') to establish a correlation with the certified CMM. Subsequently, a regular 're-mastering' process is used to account for changing environmental conditions.

Size and position measurements made immediately following re-mastering will have a comparison uncertainty of ±0.002 mm relative to the certified measurements of the master part. This specification applies where each part is fixtured to within 1 mm relative to the master part.

\*Customers should complete their own risk assessment on delivery of the machine to define their own PPE requirements.

Equator 300 machine specifications - Scanning	
<b>Probe type</b>	Renishaw 3 axis SP25 analogue scanning probe
<b>Maximum scanning velocity</b>	200 mm/s
<b>Maximum scanning acceleration</b>	1500 mm/s <sup>2</sup>
<b>Maximum scanning rate</b>	1000 points/s

\* Maximum scanning speed cannot be guaranteed as it is affected by feature type/size/finish and stylus configurations.

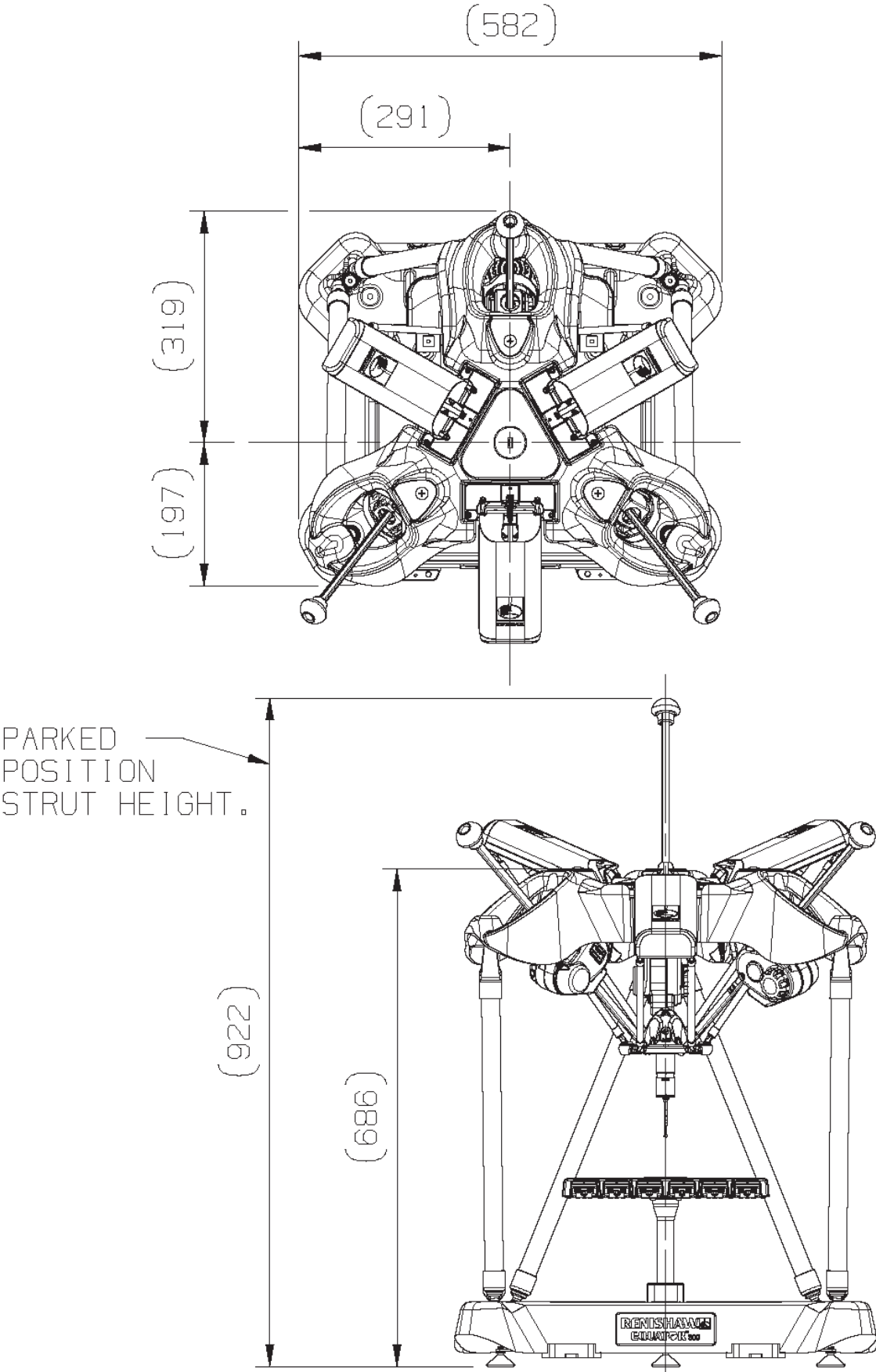
Equator 300 machine specifications - Touch trigger	
<b>Probe type</b>	Renishaw 3 axis TP20 kinematic touch-trigger probe
<b>Maximum touch point velocity</b>	10 mm/s
<b>Maximum touch acceleration</b>	1500 mm/s <sup>2</sup>

## Equator 300 machine labels

A warning label on each of the three support arms for the constraint mechanism warns not to lift the machine by the support arms. The Equator machine should only be lifted using the four hand holds on the base casting.

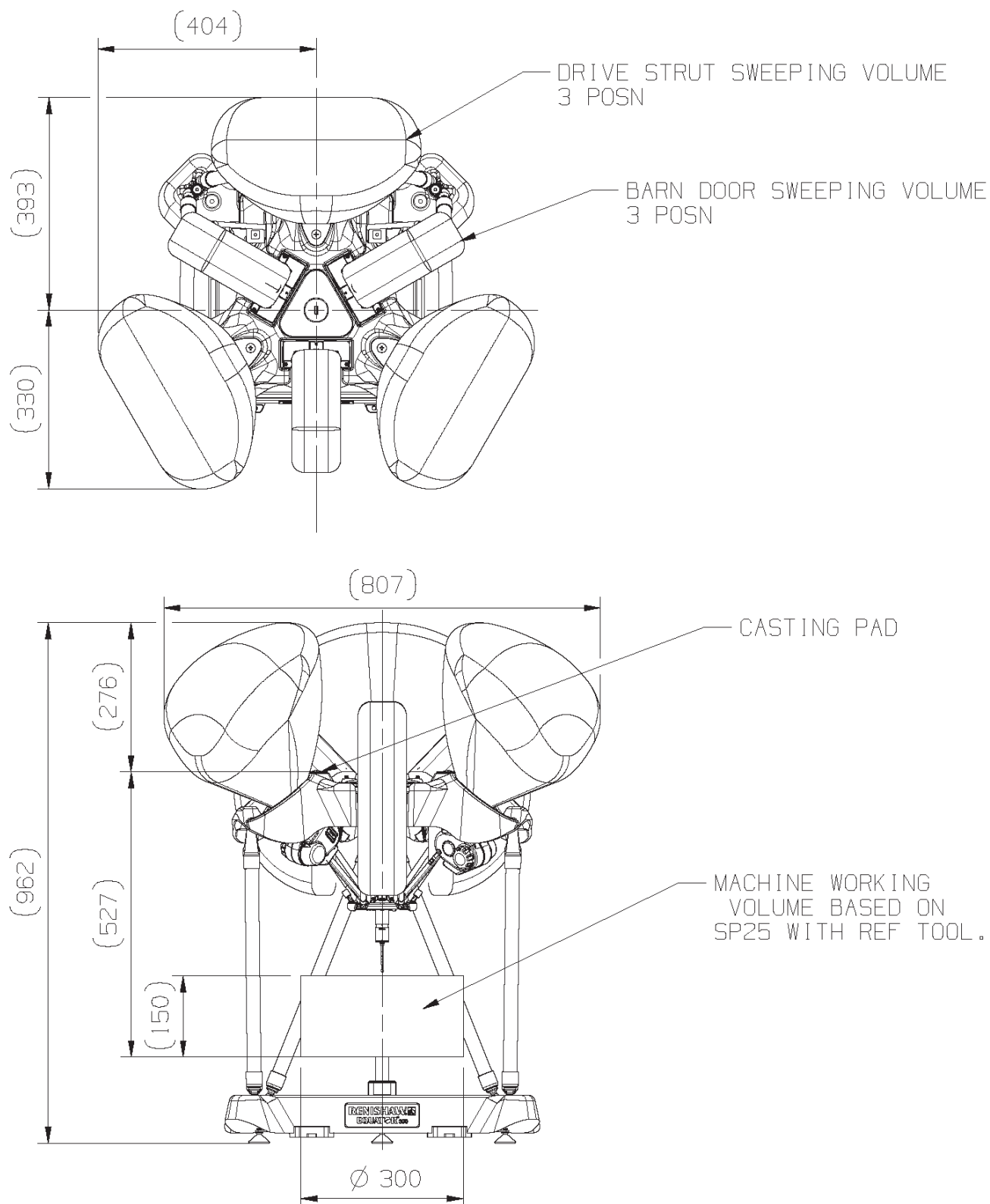


Equator 300 gauging system geometry

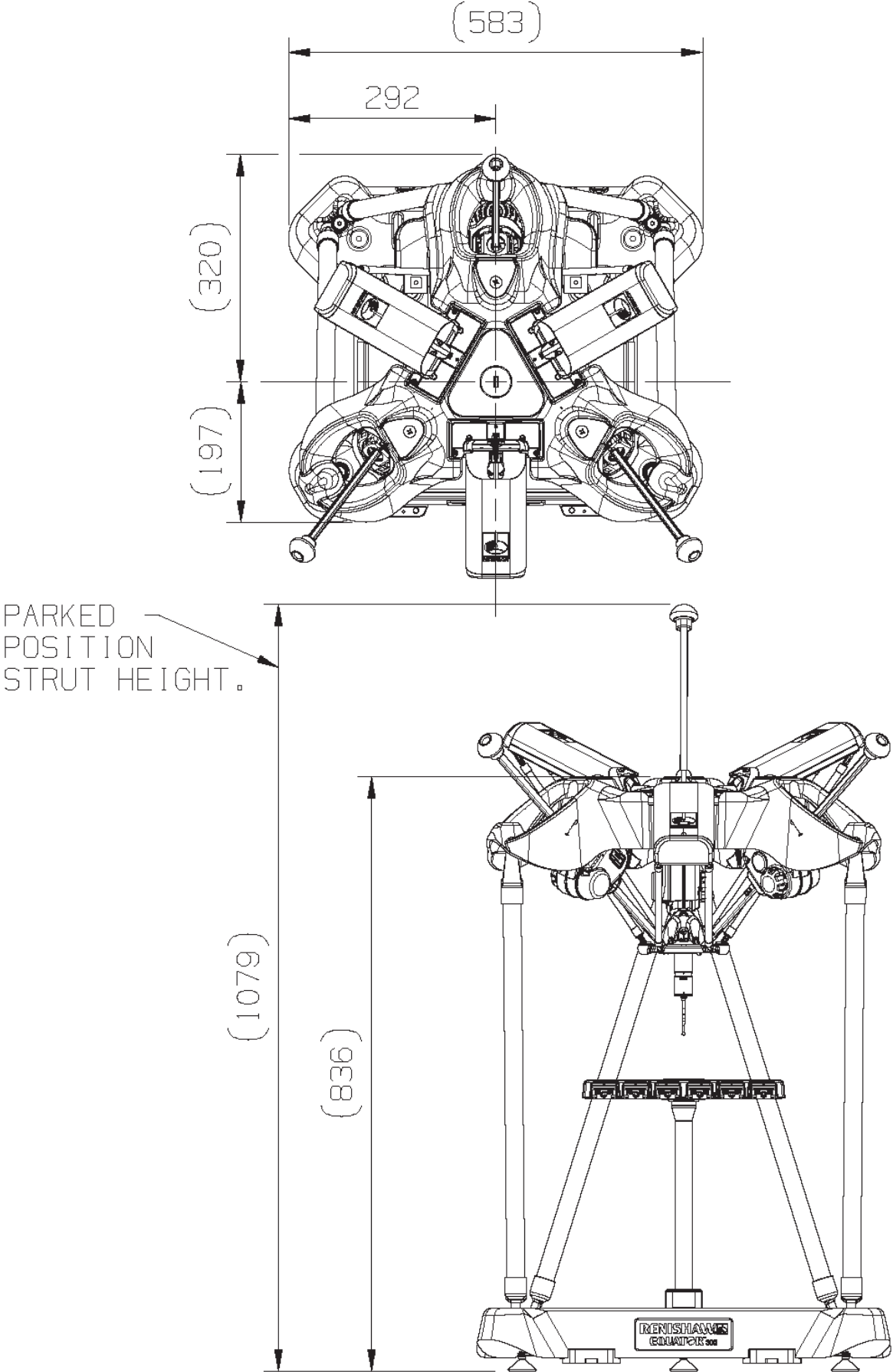




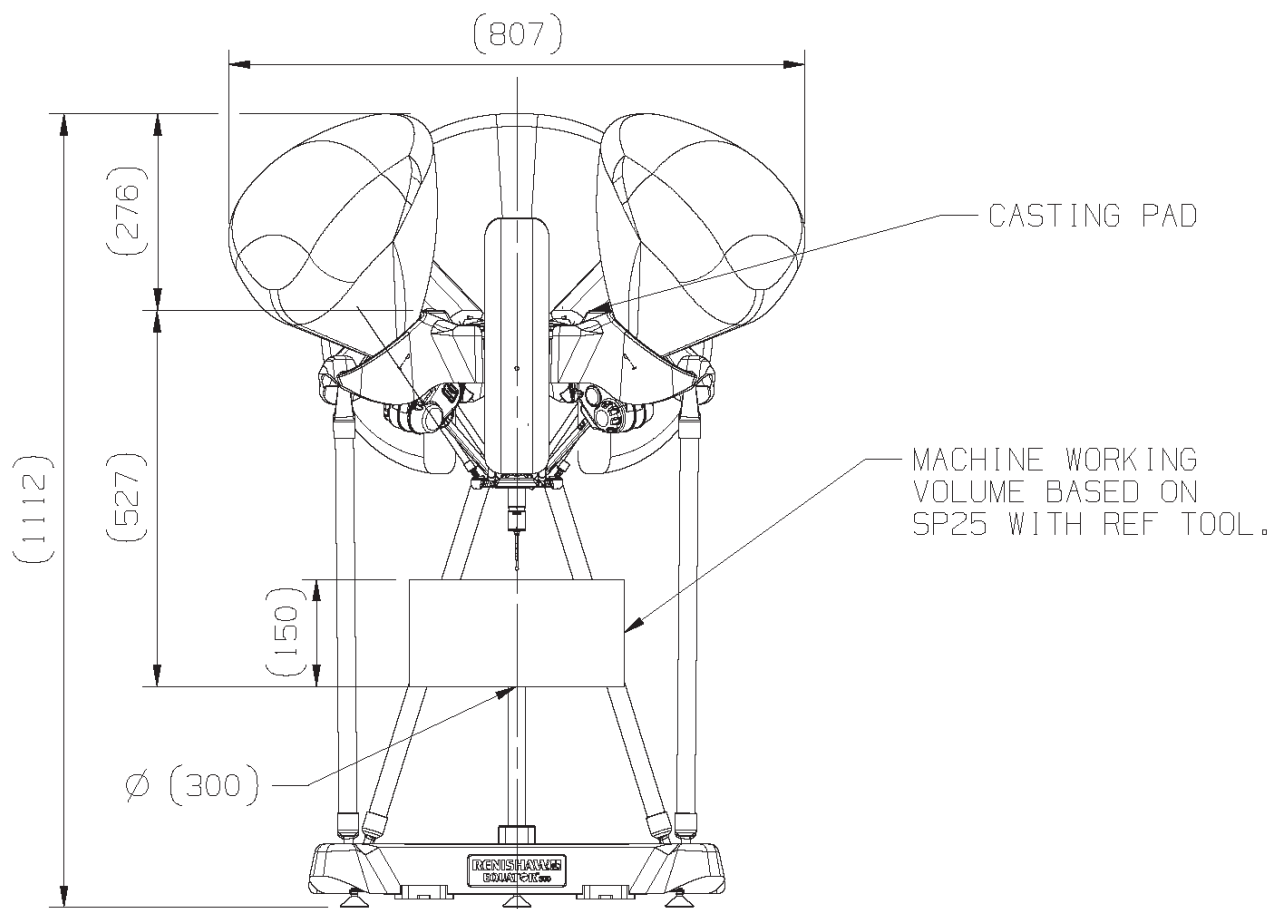
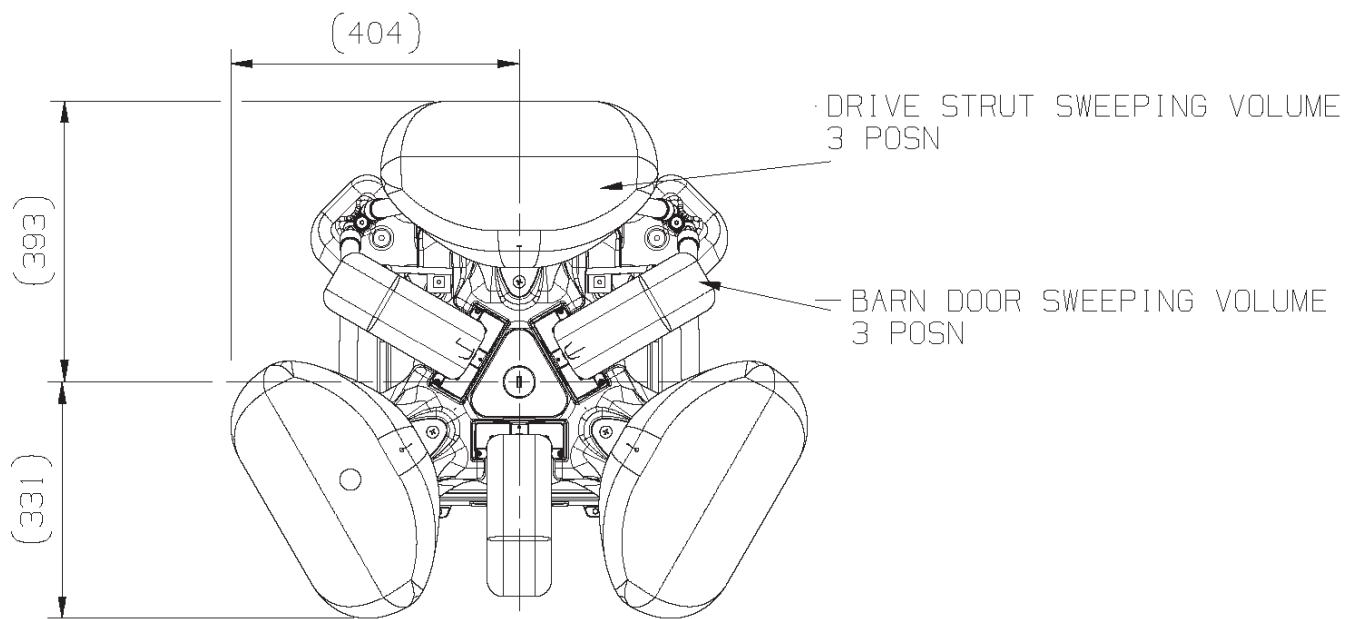
## Collision geometry



**Equator 300 Extended Height gauging system geometry**



**Collision geometry**



## Equator 500 gauging system specifications



- |  |   |
|--|---|
| 1. Base casting                                  | 10. CE marking and serial number                  |
| 2. SP25 probe assembly                           | 11. Drive housing                                 |
| 3. Floating or moving platform                   | 12. Parallel constraint mechanism                 |
| 4. Support strut                                 | 13. Fixture plate                                 |
| 5. Top casting                                   | 14. Workpiece and fixture                         |
| 6. Drive strut                                   | 15. Stop button and Button Interface, when fitted |
| 7. Counterbalance mechanism                      | 16. Blanking cap / eye bolt                       |
| 8. Upper pivot and alignment bracket             | 17. Equator Autojoint Adapter (EQ-AA1)            |
| 9. Support arm for parallel constraint mechanism |   |

## Equator 500 machine specifications

<b>Comparison uncertainty</b>	± 0.002 mm
<b>Scale resolution</b>	0.00001 mm
<b>Maximum move velocity</b>	750 mm/s
<b>Maximum move acceleration</b>	5000 mm/s <sup>2</sup>
<b>Storage temperature</b>	-25 °C to +70 °C
<b>Operating temperature</b>	+5 °C to +50 °C
<b>Operating humidity</b>	Maximum 80 %RH at 40 °C, non-condensing
<b>Machine electrical supply requirements</b>	48 V DC supplied direct from Equator Controller
<b>Repeatability of piece part in fixture</b>	1 mm
<b>Maximum workpiece weight (including fixture plate)</b>	100 kg
<b>Protective equipment suggested*</b>	Eye protection and safety shoes
<b>Guards</b>	None

The process of measuring on an Equator involves defining a series of gauge points on the component surface. Periodic calibration of a master part on a CMM establishes datum values for each gauge point. The same gauge points on the same master part are measured on Equator (known as 'mastering') to establish a correlation with the certified CMM. Subsequently, a regular 're-mastering' process is used to account for changing environmental conditions.

Size and position measurements made immediately following re-mastering will have a comparison uncertainty of ±0.002 mm relative to the certified measurements of the master part. This specification applies where each part is fixtured to within 1 mm relative to the master part.

\*Customers should complete their own risk assessment on delivery of the machine to define their own PPE requirements.

### Equator 500 machine specifications - Scanning

<b>Probe type</b>	Renishaw 3 axis SP25 analogue scanning probe
<b>Maximum scanning velocity</b>	250 mm/s
<b>Maximum scanning acceleration</b>	1500 mm/s <sup>2</sup>
<b>Maximum scanning rate</b>	2000 points/s

\* Maximum scanning speed cannot be guaranteed as it is affected by feature type/size/finish and stylus configurations.

### Equator 500 machine specifications - Touch trigger

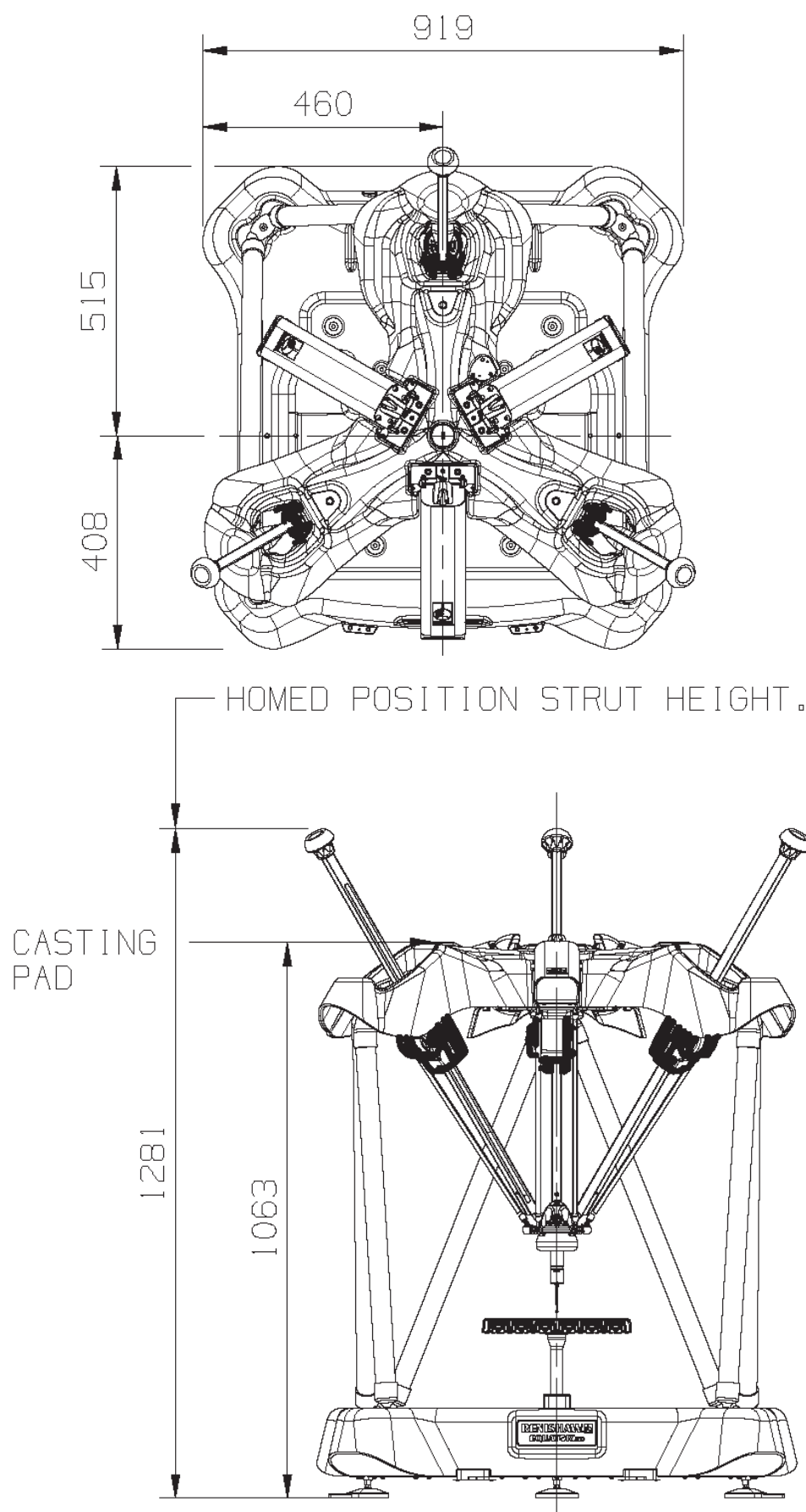
<b>Probe type</b>	Renishaw 3 axis TP20 kinematic touch-trigger probe
<b>Maximum scanning velocity</b>	10 mm/s
<b>Maximum scanning acceleration</b>	1500 mm/s <sup>2</sup>

## Equator 500 machine labels

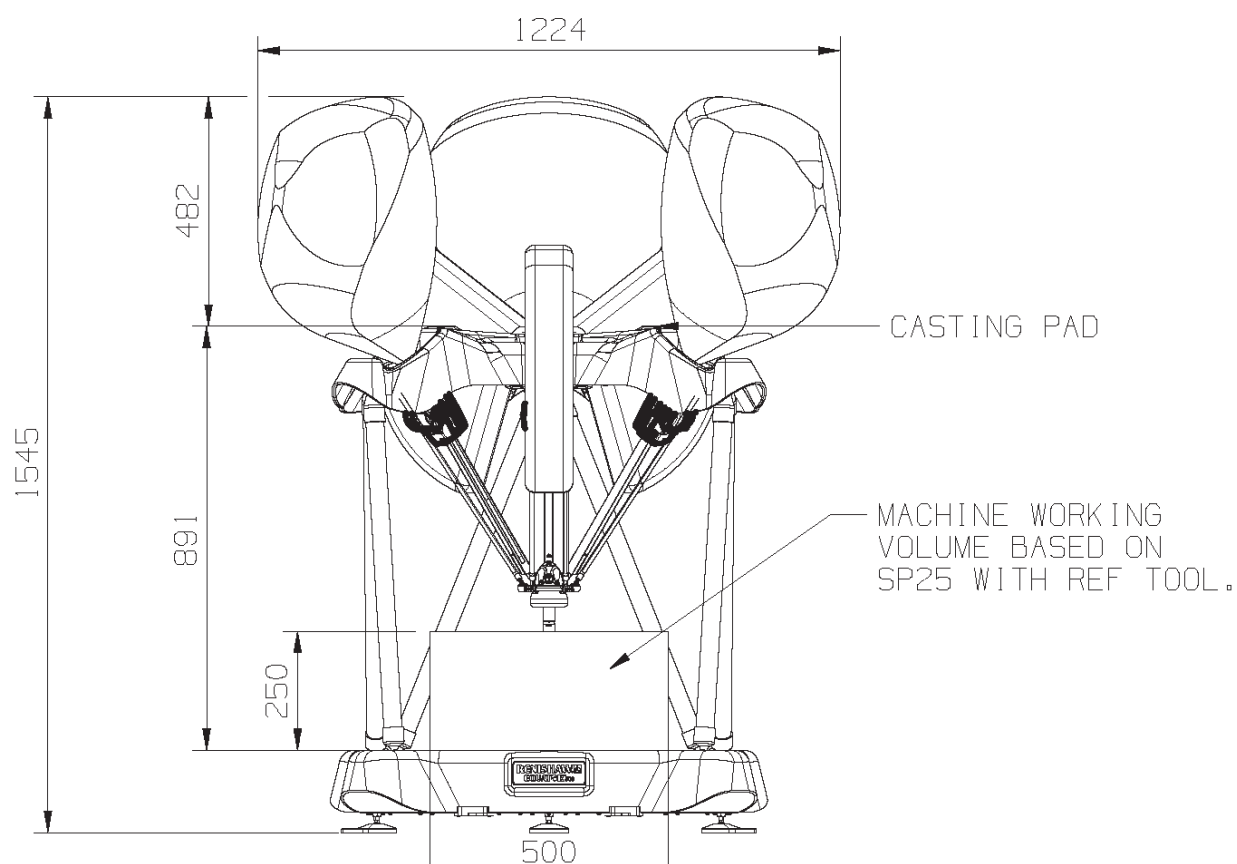
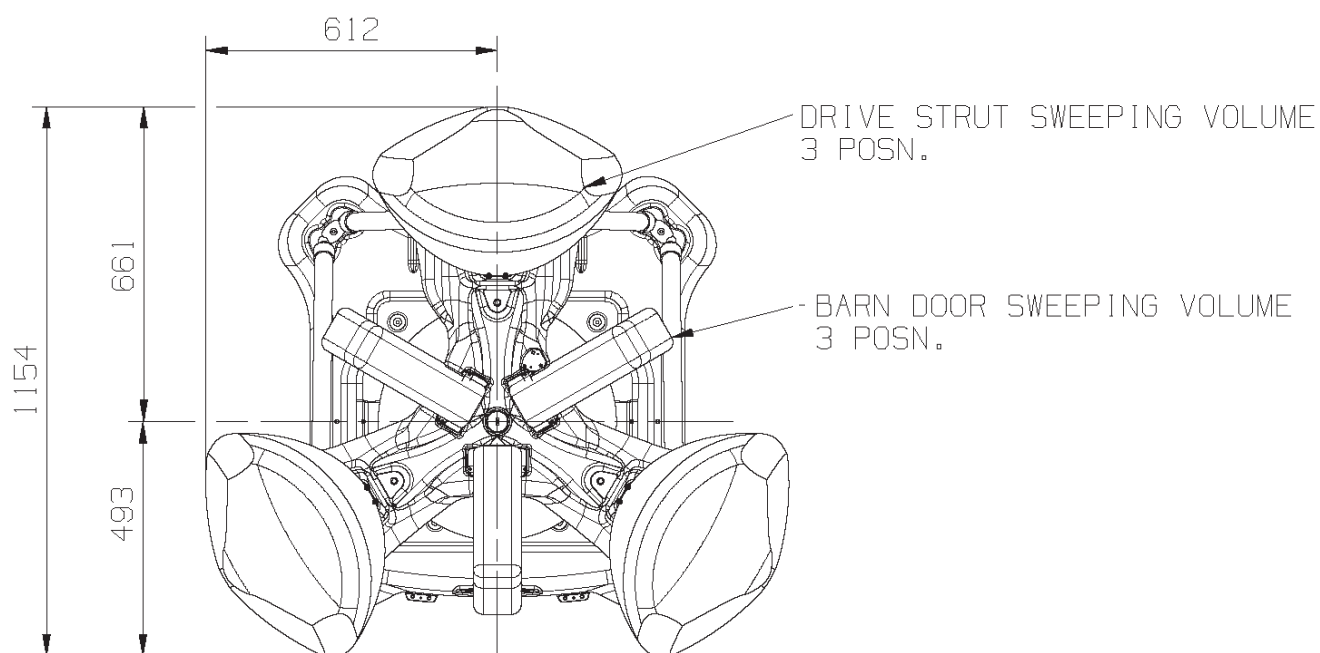
A warning label on each of the three support arms for the constraint mechanism warns not to lift the machine by the support arms. The Equator machine should only be lifted using mechanical means.



Equator 500 gauging system geometry

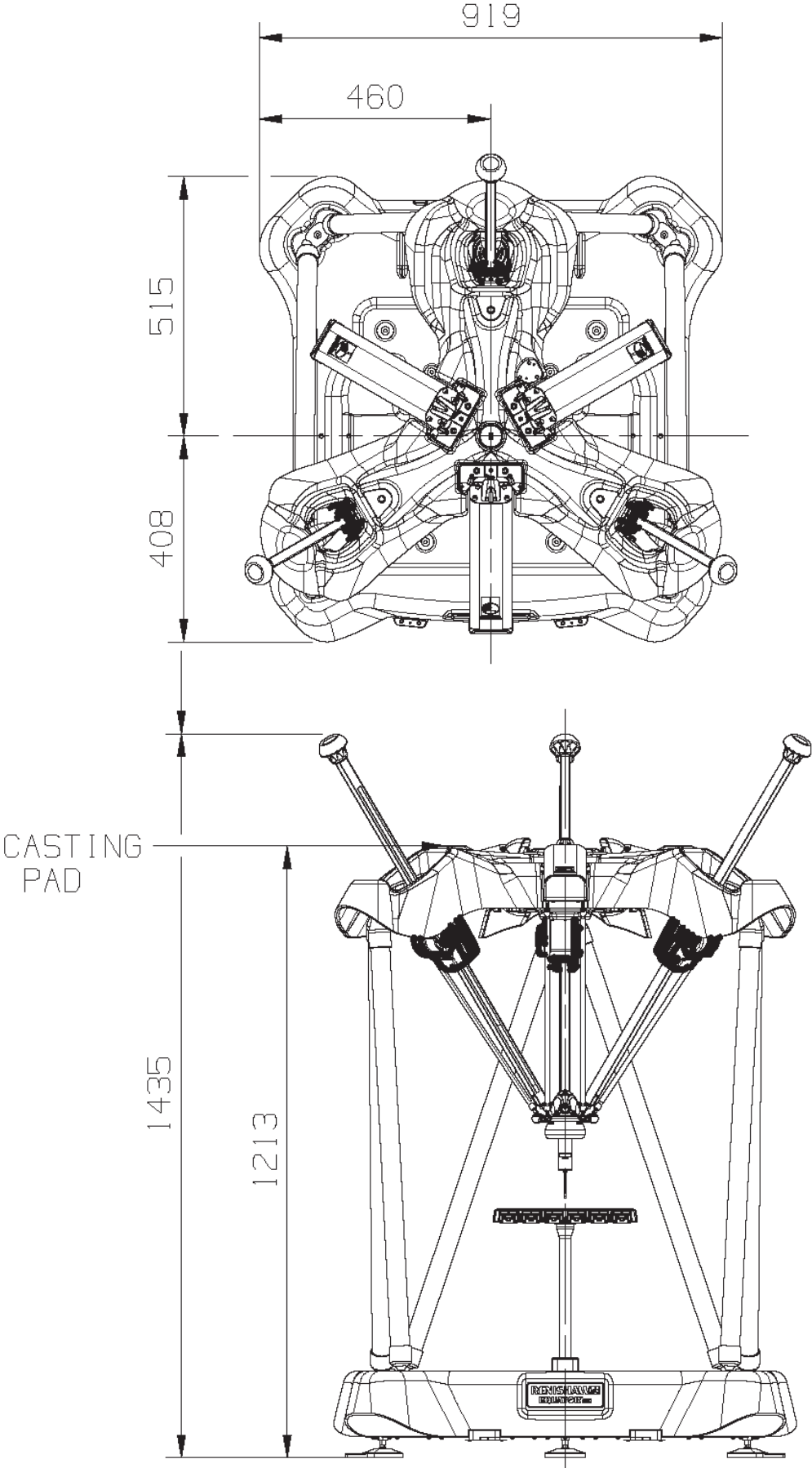


## Collision geometry

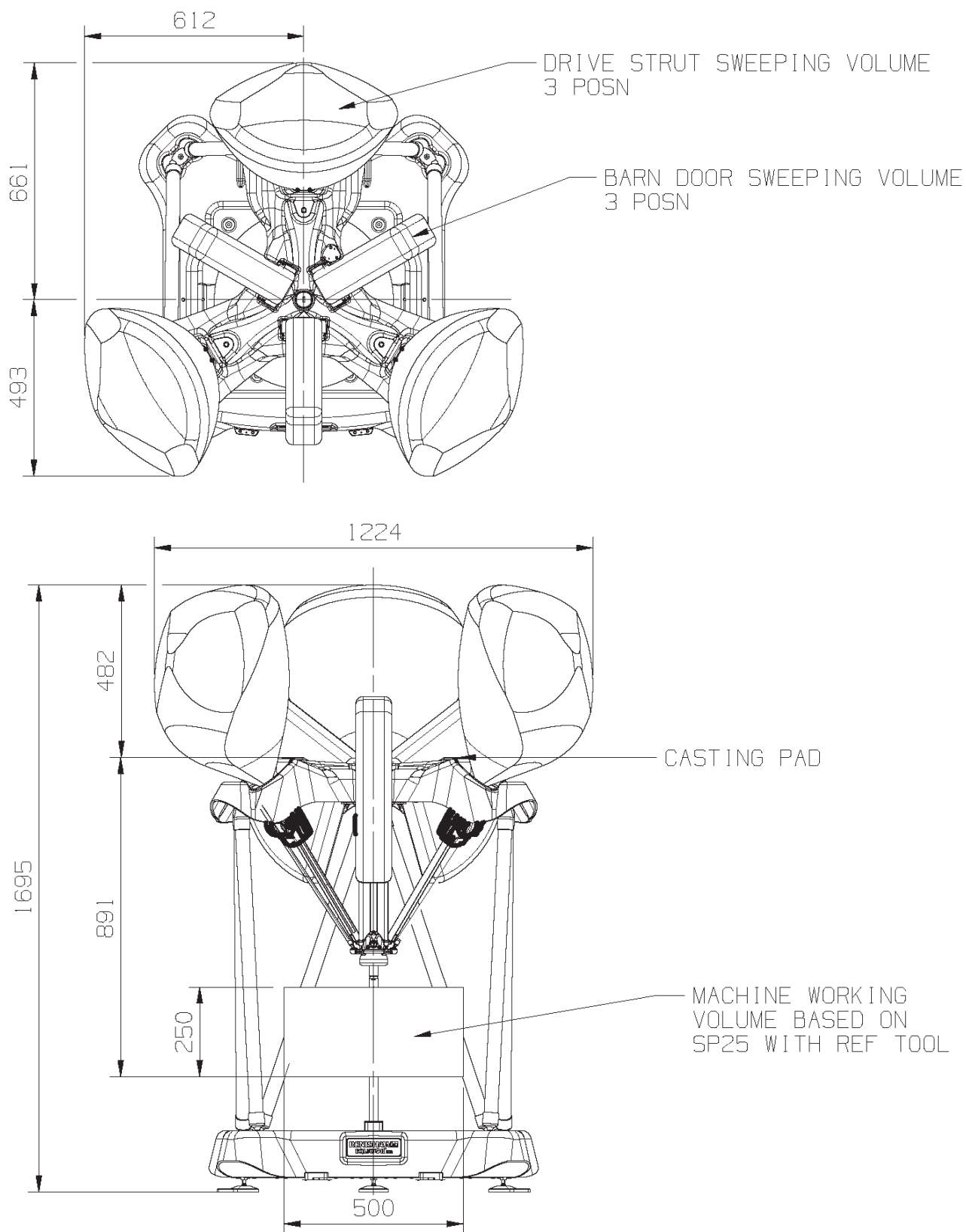




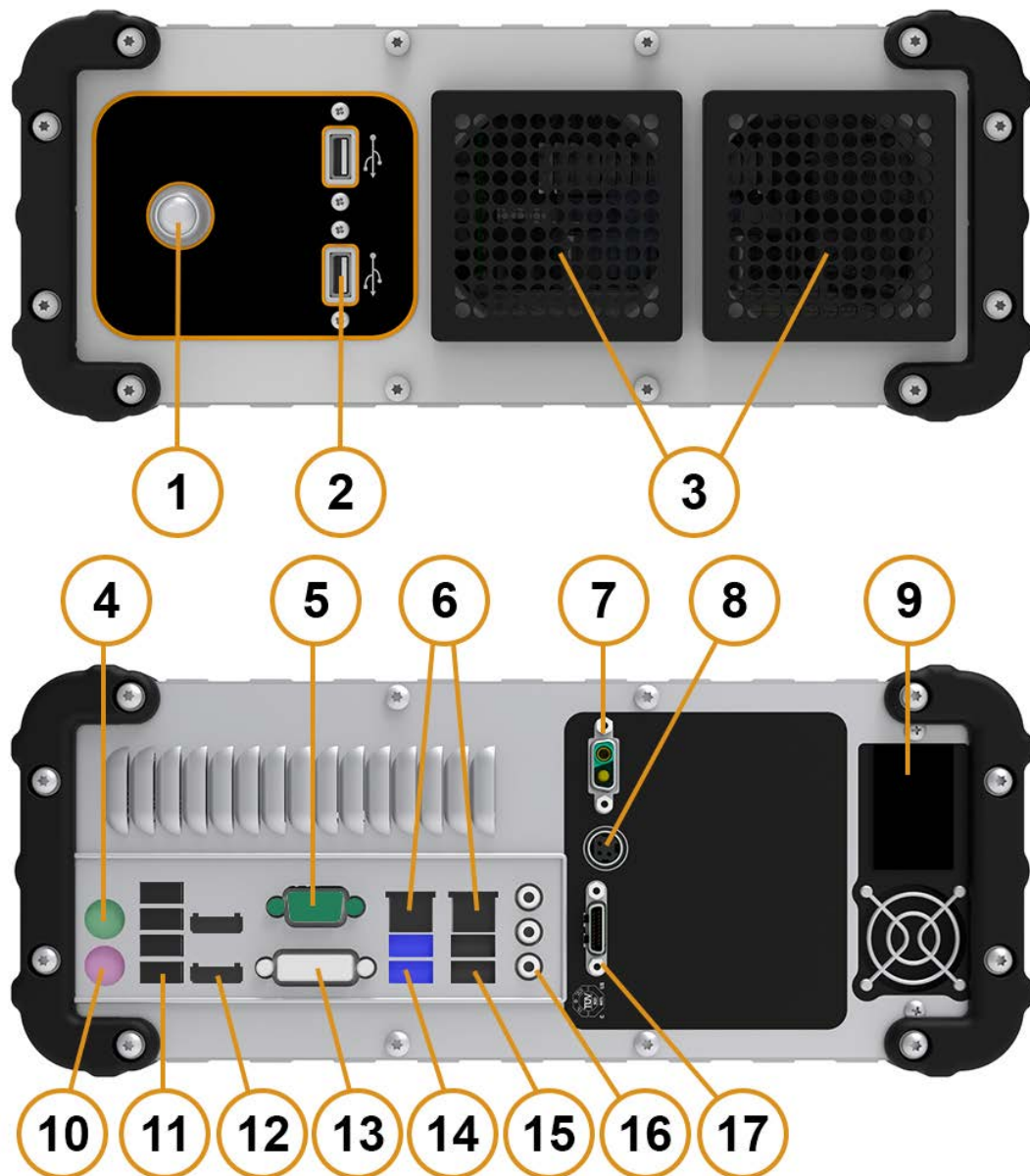
**Equator 500 Extended Height gauging system geometry**



## Collision geometry



## Equator Controller specifications - Version 08



- |                                |   |
|--------------------------------|---|
| 1. Power button                | 10. PS/2 port - Keyboard                              |
| 2. 2x USB 3.0 ports            | 11. 4x USB 2.0 ports                                  |
| 3. Fans and filters            | 12. Display Port 1 and 2 (DPP1 & DPP2)                |
| 4. PS/2 port - Mouse           | 13. Digital Visual Interface (DVI)                    |
| 5. Serial port (Not supported) | 14. 2x USB 3.0 ports                                  |
| 6. LAN1 and LAN2 ports         | 15. 2x USB 2.0 ports                                  |
| 7. DC Power Out (48V)          | 16. Audio (Audio OUT supported, Mic IN not supported) |
| 8. DC Power Out (24V)          | 17. PCIe COMMS  |
| 9. Power supply and switch     |   |

Equator Controller specifications and electrical ratings	
Controller electrical supply requirements	100 V AC - 240 V AC $\pm 10\%$ , 50 Hz - 60 Hz
Maximum rated power consumption	300 W
Maximum power consumption*	190 W
Typical power consumption**	100 W
Controller dimensions (W x D x H)***	140 mm x 330 mm x 350 mm
Controller weight	8 kg
Communication with Equator	PCleexpress
Display type	VGA or Display port
Display resolution	1280 p x 1024 p

\* Peak consumption at power-up

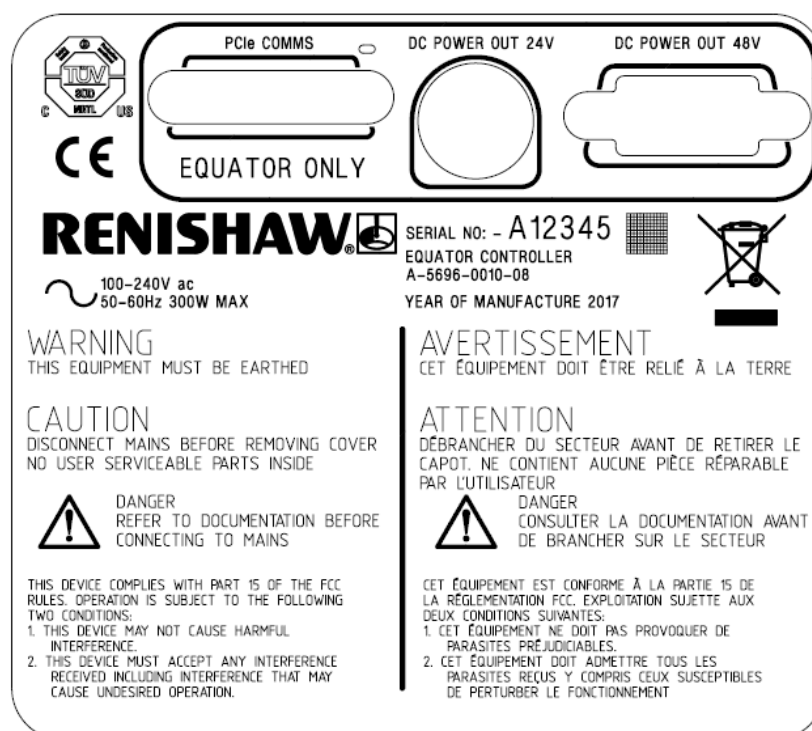
\*\* 3-axis gauging system taking touch points under DCC control + peak consumption at power-up

\*\*\* Allow an additional 100 mm for cable connectors and cables

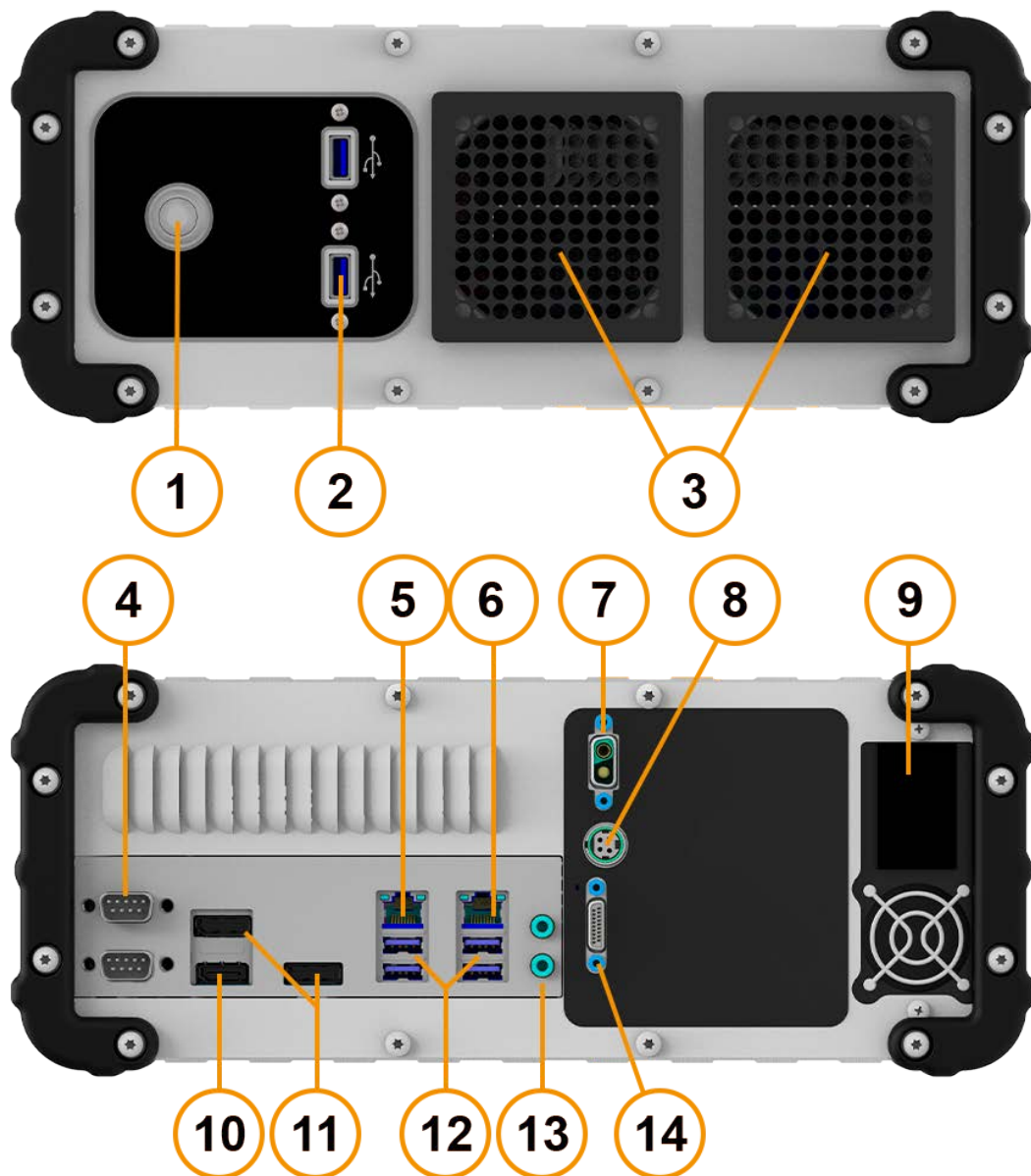
Operating conditions	
Altitude	Maximum 2000 m
Operating temperature	+5 °C to +50 °C
Storage temperature	-25 °C to +70 °C
Relative humidity	Maximum 80% RH at 40 °C, non-condensing
Transition voltages	Installation category II
Pollution degree	2

The Equator Controller is specified to operate under the following conditions as defined in BS EN 61010-1:2001.

## Equator Controller labels



## Equator Controller specifications - Version 09



- |                                    |   |
|------------------------------------|---|
| 1. Power button                    | 9. Power supply and switch                            |
| 2. 2x USB 3.0 ports                | 10. HDMI port   |
| 3. Fans and filters                | 11. Display Port 1 and 2 (DPP1 & DPP2)                |
| 4. 2x Serial ports (Not supported) | 12. 4x USB 3.1 ports                                  |
| 5. LAN1 port (RJ-45)               | 13. Audio (Audio OUT supported, Mic IN not supported) |
| 6. LAN2 port (RJ-45)               | 14. PCIe COMMS  |
| 7. DC Power Out (48V)              |   |
| 8. DC Power Out (24V)              |   |

Equator Controller specifications and electrical ratings	
Controller electrical supply requirements	100 V AC - 240 V AC $\pm 10\%$ , 50 Hz - 60 Hz
Maximum rated power consumption	300 W
Maximum power consumption*	190 W
Typical power consumption**	100 W
Controller dimensions (W x D x H)***	140 mm x 330 mm x 350 mm
Controller weight	8 kg
Communication with Equator	PClexpress
Display type	HDMI or Display port
Display resolution	1920 x 1080 60 hz

\* Peak consumption at power-up

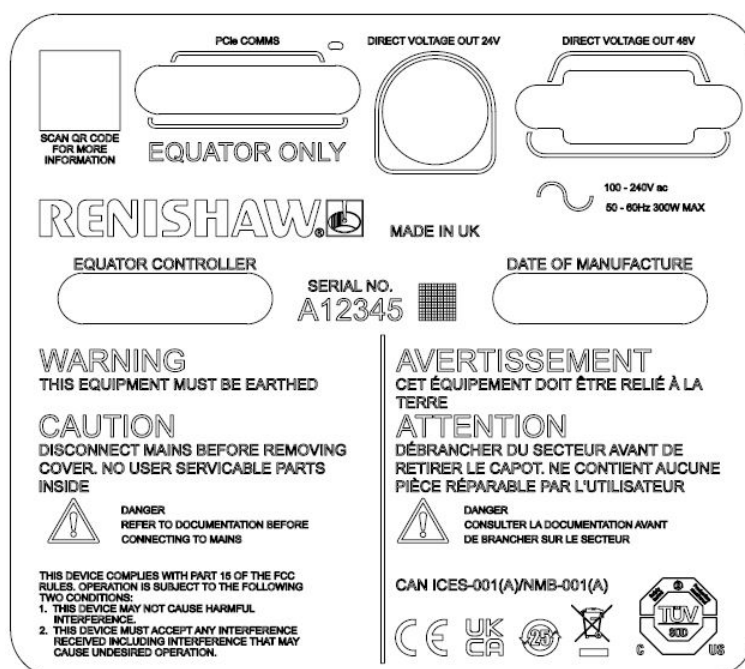
\*\* 3-axis gauging system taking touch points under DCC control + peak consumption at power-up

\*\*\* Allow an additional 100 mm for cable connectors and cables

Operating conditions	
Altitude	Maximum 2000 m
Operating temperature	+5 °C to +50 °C
Storage temperature	-25 °C to +70 °C
Relative humidity	Maximum 80% RH at 40 °C, non-condensing
Transition voltages	Installation category II
Pollution degree	2

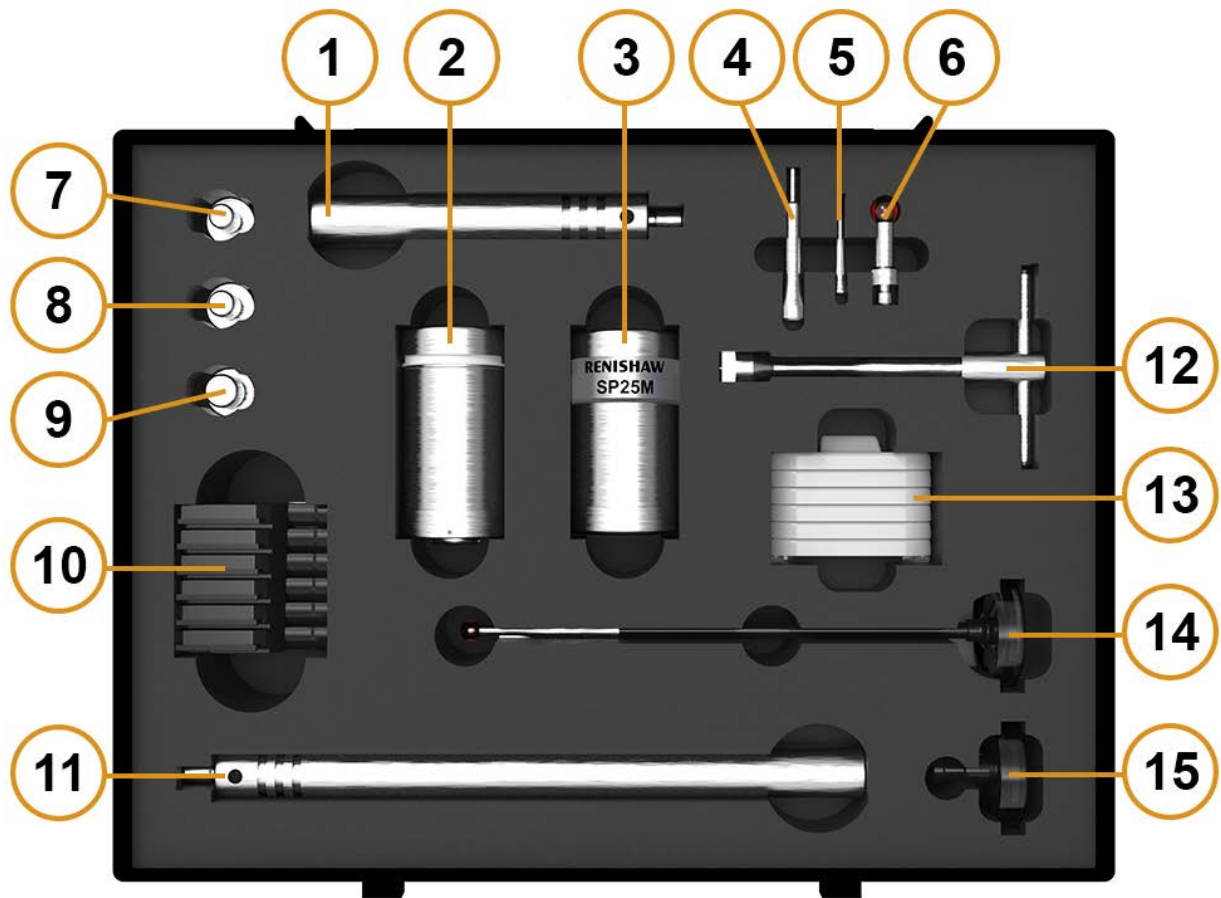
The Equator Controller is specified to operate under the following conditions as defined in BS EN 61010-1:2001.

## Equator Controller labels





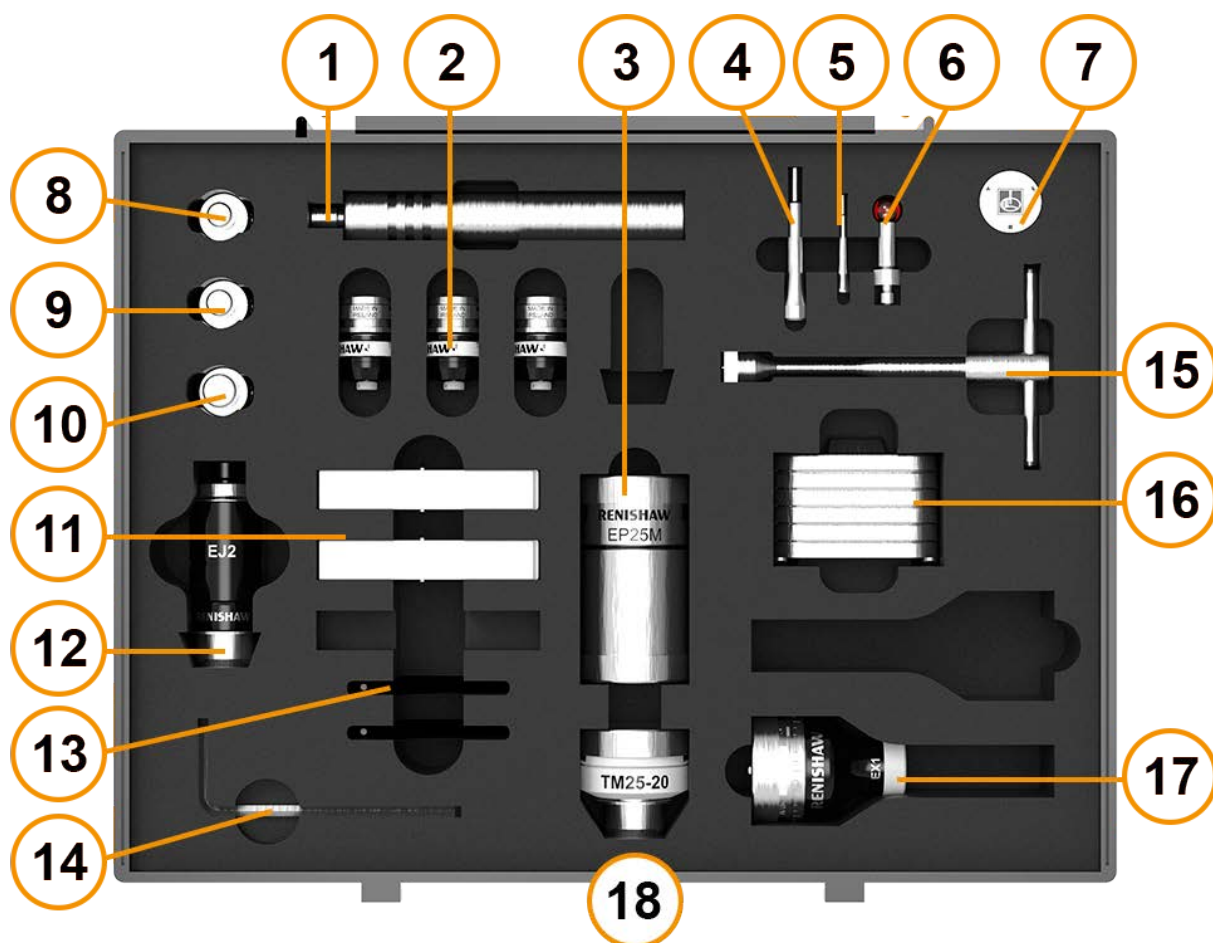
## Probe kit specifications - Scanning



- |                                     |                         |
|-------------------------------------|-------------------------|
| 1. M4 to M5 78 mm Spacer            | 13. Rack Port Clip      |
| 2. SM25-2/SM25-3 Module             | 14. SH25 Reference Tool |
| 3. SP25M                            | 15. SHSP stylus         |
| 4. Stylus Tool D1.88/1.83           |                         |
| 5. Stylus Tool D1.13/1.10           |                         |
| 6. M4 STY D6R L17, 5 EWL13, 5d4.5SS |                         |
| 7. M5 to M6 20 mm Spacer            |                         |
| 8. M5 to M8 20 mm Spacer            |                         |
| 9. M5 to 1/4" 20 mm Spacer          |                         |
| 10. Port Adaptor PA25-SH            |                         |
| 11. M5 to M5 150 mm Spacer          |                         |
| 12. Equator Joint Key               |                         |



## Probe kit specifications - Touch Trigger



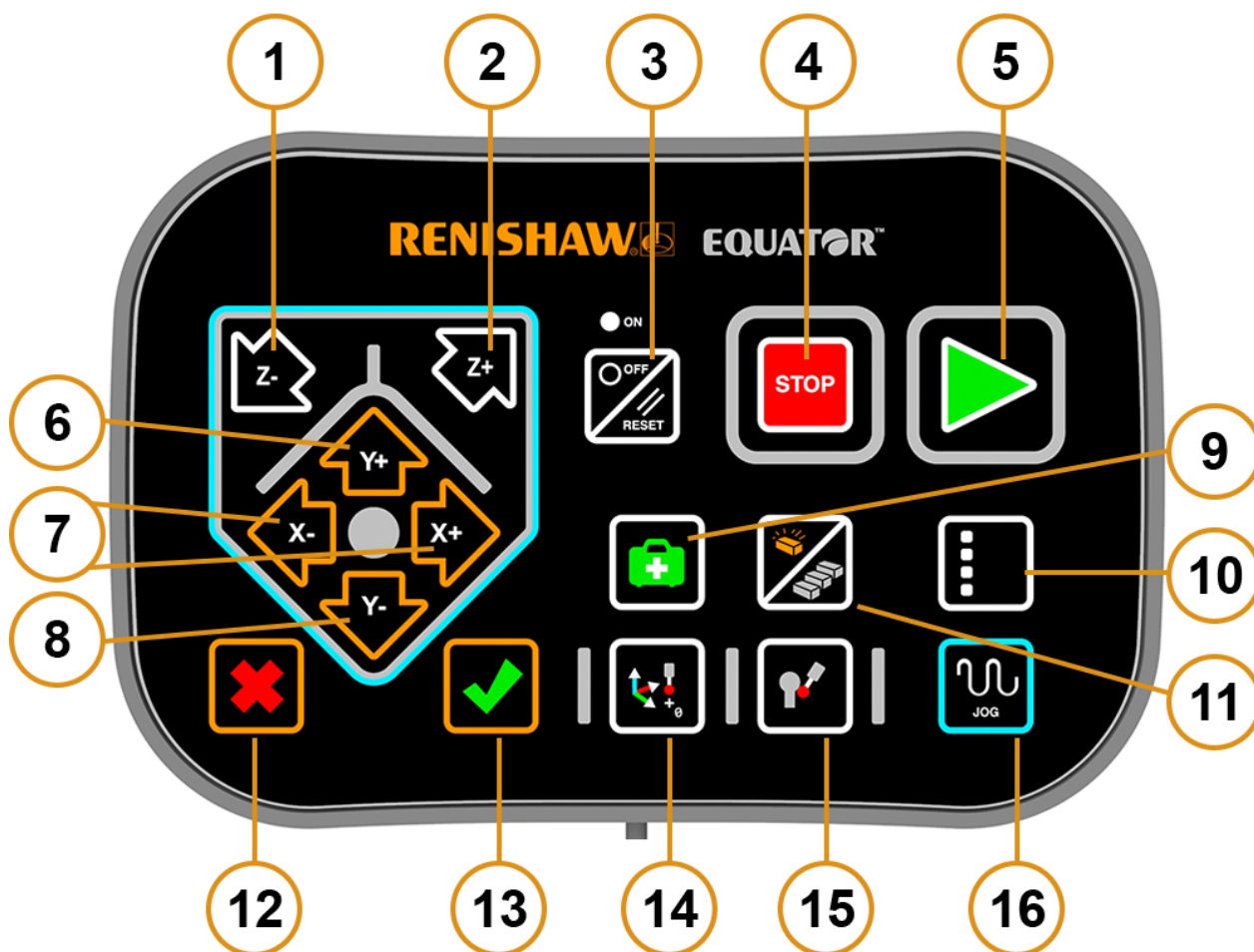
- |                                     |                           |
|-------------------------------------|---------------------------|
| 1. M4 to M5 78 mm Spacer            | 12. EJ2                   |
| 2. TP20 Module x3                   | 13. S1 Spanner x 2        |
| 3. EP25M                            | 14. Wrench Hex Key 2.5 mm |
| 4. Stylus Tool D1.88/1.83           | 15. Equator Joint Key     |
| 5. Stylus Tool D1.13/1.10           | 16. Rack Port Clip        |
| 6. M4 STY D6R L17, 5 EWL13, 5d4.5SS | 17. EX1 - 35 mm Extension |
| 7. TP20 Blanking Cap                | 18. TM25-20               |
| 8. M5 to M6 20 mm Spacer            |                           |
| 9. M5 to M8 20 mm Spacer            |                           |
| 10. M5 to 1/4" 20 mm Spacer         |                           |
| 11. M2 D4R L20 and M2 D6R L10 styli |                           |

## MCU/lite-2 joystick specifications



1. Stop button
2. Speed override
3. Slow speed movement buttons
4. Fast speed movement buttons
5. 3-axis joystick
6. Joystick X,Y,Z axis lock buttons
7. Take point / cancel last point button

## Equator Button Interface specifications (MODUS 1.x systems only)



- |                                |  |
|--------------------------------|--|
| 1. Z- direction button         | 11. Switch between Master or Measure mode button |
| 2. Z+ direction button         | 12. Cancel button                                |
| 3. Off/Reset button            | 13. Confirm button                               |
| 4. Stop button                 | 14. Initial point alignment program button       |
| 5. Play button                 | 15. Calibration button                           |
| 6. Y+ direction button         | 16. Jog enable button                            |
| 7. X- and X+ direction buttons |  |
| 8. Y- direction button         |  |
| 9. Recovery button             |  |
| 10. Switch windows button      |  |

# Shipping/Handling/Storage

## Pre-delivery

Before receiving the Equator gauging system, there are a number of considerations that should be made. These are as follows:

### Equator 300 gauging system

- The Equator 300 system is very capable measuring device. When working with the level of precision the system can achieve, high levels of vibration will have a negative effect. It is recommended that the machine should be positioned on a sturdy platform such as a workbench with 4 legs constructed of cross braced steel box section.
- The Equator 300 system requires 2 single phase power sockets. One socket will be required to power the Equator 300 Controller and the other to power the display monitor. It is recommended that 2 single phase power sockets be in close proximity to the planned location where the machine will be positioned.

### Equator 500 gauging system

- The Equator 500 system will arrive in a packaging crate. The crate is larger than a standard single door but will fit through a set of standard height double doors. The crate has positions to allow it to be lifted via a forklift or other forked mechanical lifting system. The packaged machine weighs 155 kgs and no attempt should be made to manually lift it. It is recommended that a suitable forked mechanical lifting system be available for the delivery and set up of the Equator 500 system.
- The Equator 500 system when unpacked will not fit through a standard single door but will fit through a set of standard double doors. It is recommended that the route used to take the Equator 500 from its point of receipt to its final position where it will be operated, be checked to make sure that the Equator 500 system will fit through the points of access.
- The unpacked Equator 500 system (without a fixture plate) weighs 75 kgs. It is therefore not recommended that it be manually lifted. The Equator 500 system has eye bolts on the top which can be used to lift the machine using a hoist or gantry crane. It is recommended that a suitable forked mechanical lifting system, mechanical hoist or gantry crane be available for the manoeuvring and positioning of the machine.
- If a hoist or gantry crane is not available, the Equator 500 system has clearance underneath for a forked mechanical lifting system (extreme care should be taken when lifting the machine using this method to make sure not to damage the machine and that the weight of the machine is evenly distributed).
- The Equator 500 system is very capable measuring device. When working with the level of precision the system can achieve, high levels of vibration will have a negative effect. It is recommended that the machine should be positioned on a sturdy platform such as a workbench with 4 legs constructed of cross braced steel box section.

- The Equator 500 system requires 2 single phase power sockets. One socket will be required to power the Equator 500 Controller and the other to power the display monitor. It is recommended that 2 single phase power sockets be in close proximity to the planned location where the machine will be positioned.

## Contents of boxes

The Equator gauging system is delivered in several boxes. The larger box contains the machine and relevant accessories, other boxes contain the controller, stop button or joystick, probe kit and relevant accessories.

### Equator 300 gauging system

- When placed in its original packaging, the Equator 300 machine can be moved by forklift or sack truck. Over shorter distances, it can be moved manually by two people using the hand holds on the side of the larger box.
- The system should be transported in the original Equator packaging to ensure that no parts get lost or damaged.
- Lifting or moving the Equator 300 should only be attempted by two people, using the hand hold locations provided in the base casting.
- Do not move or lift the machine by the top casting, the support arms of the constraint mechanism, the support legs, or the three drive struts (e.g. by holding the orange protectors or any part of the drive strut mechanism).

Equator 300	
Gross weight	60 kg
Net weight	25 kg
Storage temperature	-25 °C to +70 °C

### Equator 500 gauging system

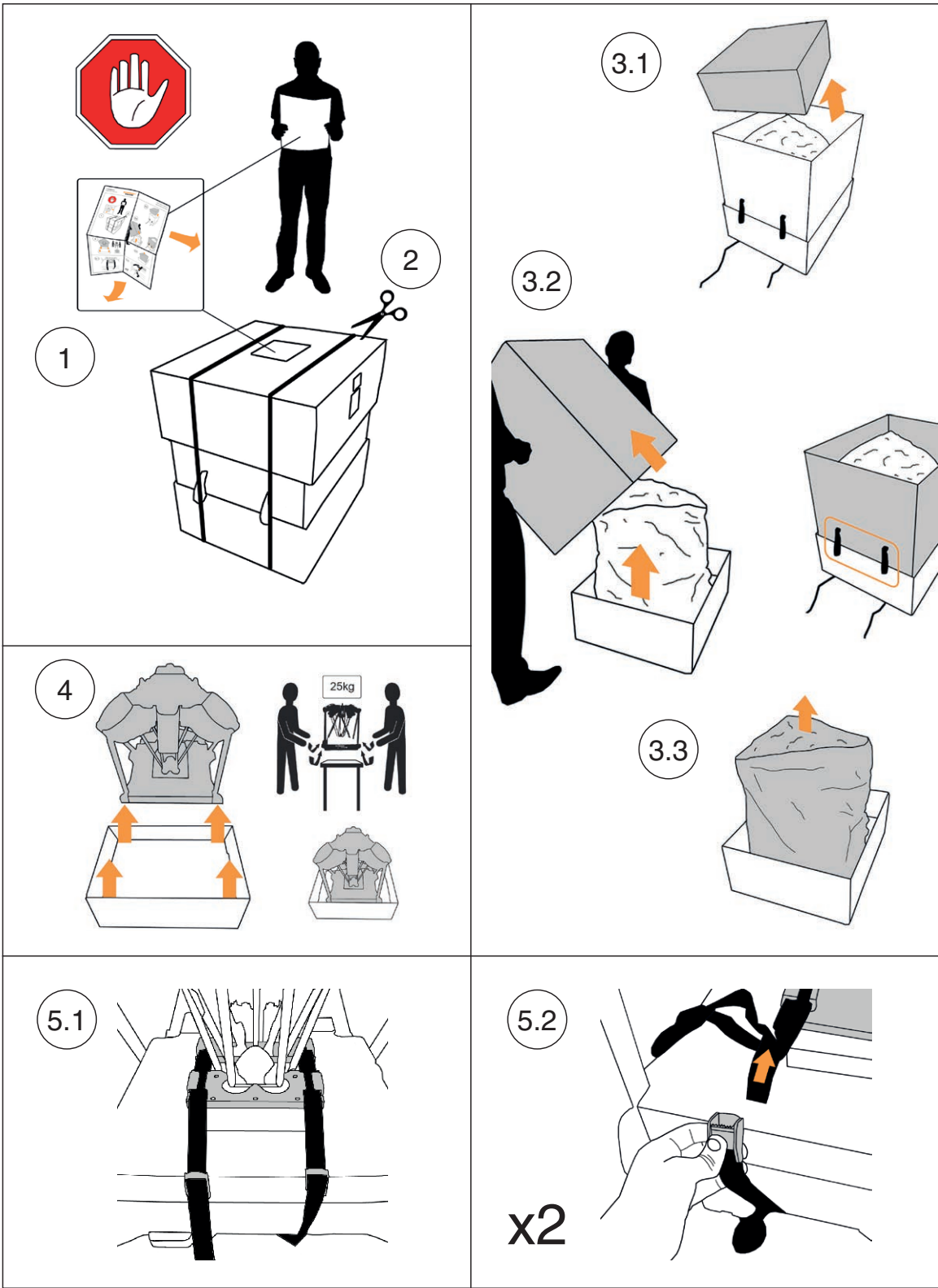
- The weight of the Equator 500 unpacked is 75 kg and therefore it is advised that the machine is only lifted using mechanical means. A high lift pallet truck can be used under the machine base, or a lifting arm can be used with the supplied eye bolts from the top casting. Once in position, the eye bolts can be removed and the supplied blanking caps inserted.
- If inserting pallet truck forks under the base, be careful of drain pipe and cable clip locations, and ensure that the forks are properly supporting the base, i.e. inserted fully past the casting.
- The Equator 500 should only be mechanically lifted using, for example, a gantry crane, forklift, etc. There are eye bolts on the top casting of the Equator 500 to allow for the use of lifting straps or a harness. Each eye bolt supplied with the Equator 500 has been rated to a safe working load of 240 kg, and manufactured to DIN 850. Renishaw only guarantees the integrity of the eye bolts supplied for the initial installation of the unit. Should you wish to use this equipment for subsequent lifts, it is your responsibility to ensure it is inspected in accordance with local legislative requirements before use.

Equator 500	
Gross weight	155 kg
Net weight	75 kg
Storage temperature	-25 °C to +70 °C

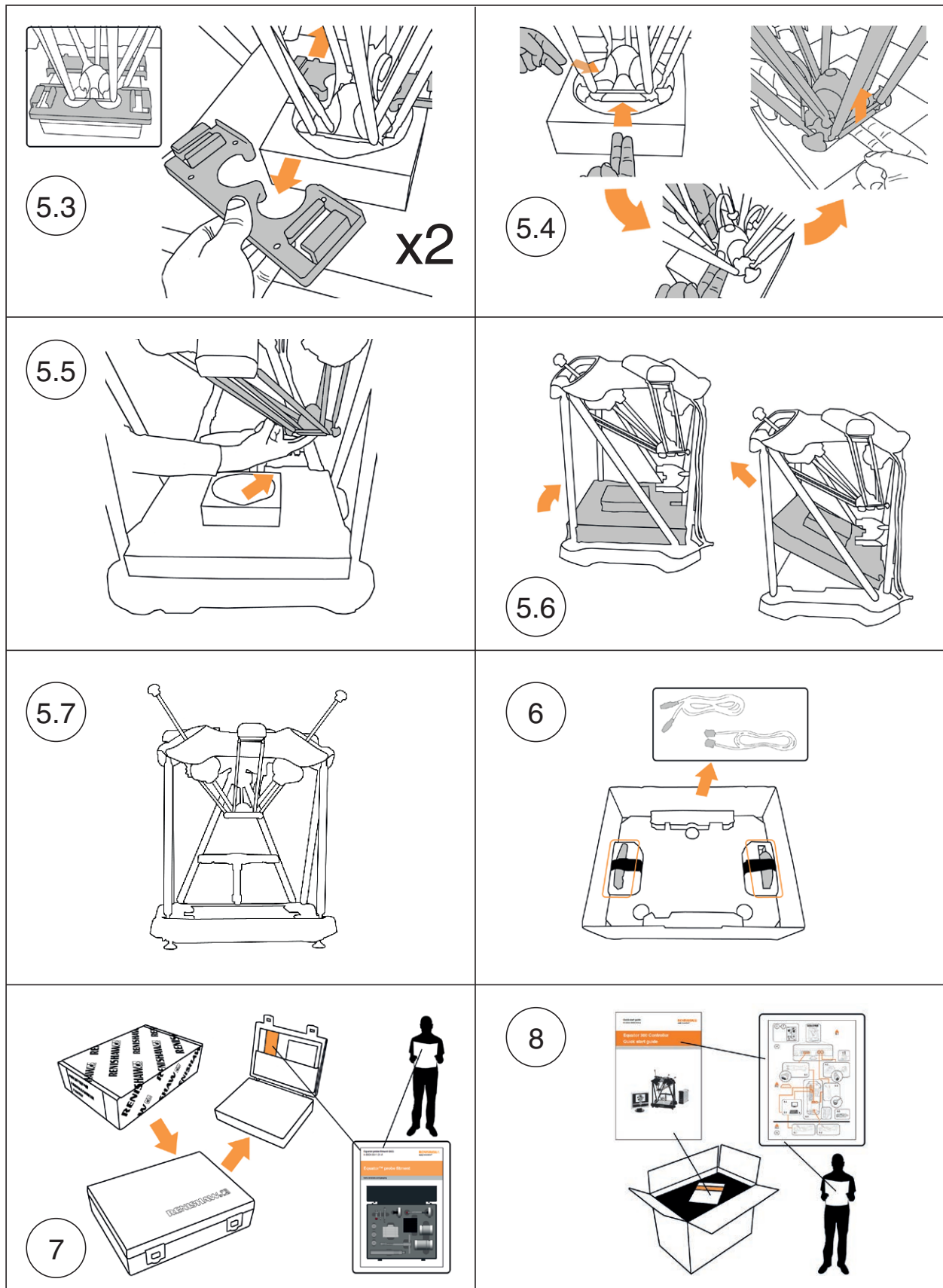
**Equator Controller**

Equator Controller	
Gross weight	14 kg
Net weight	8 kg
Storage temperature	-25 °C to +70 °C

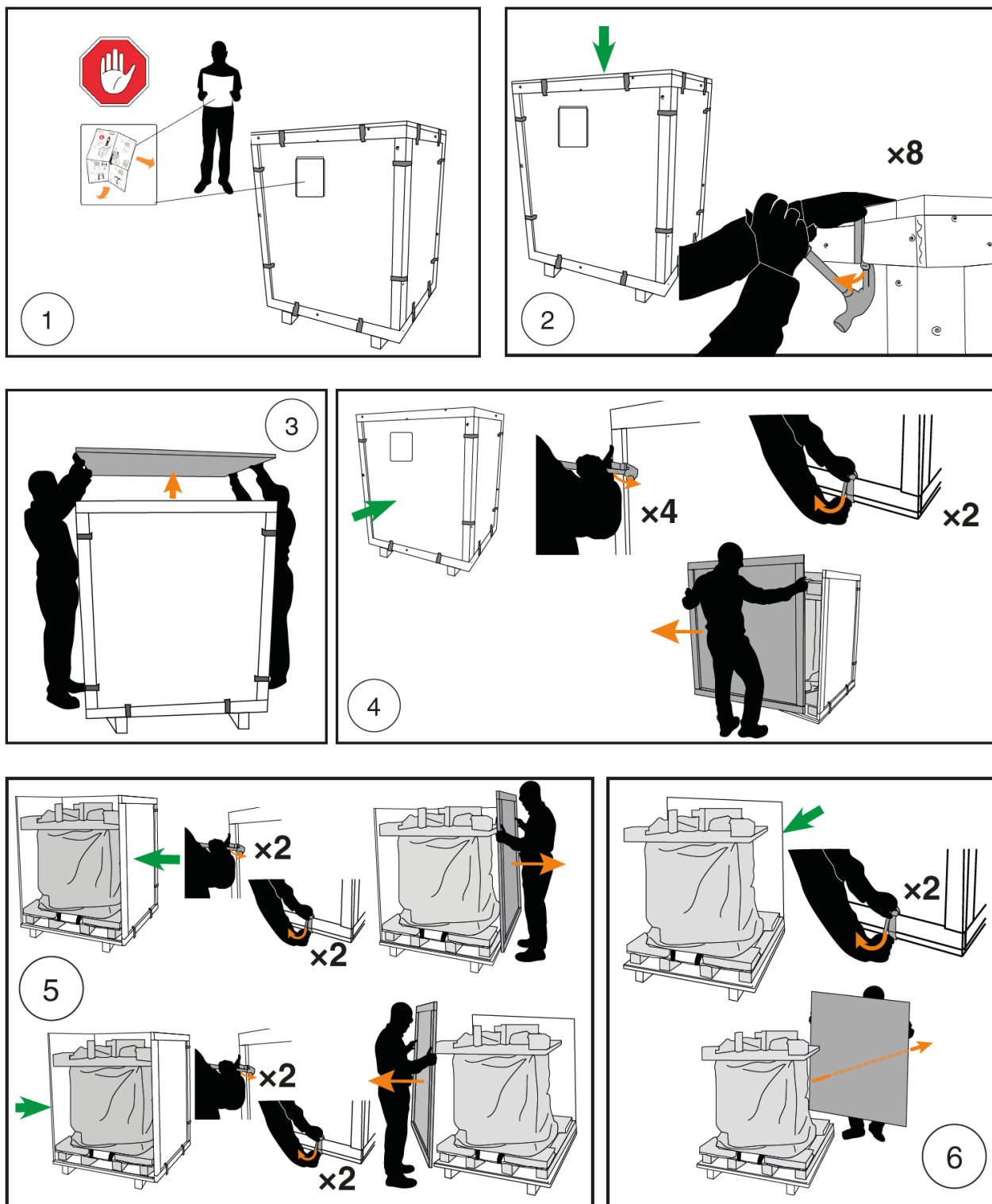
**Unboxing the Equator 300**

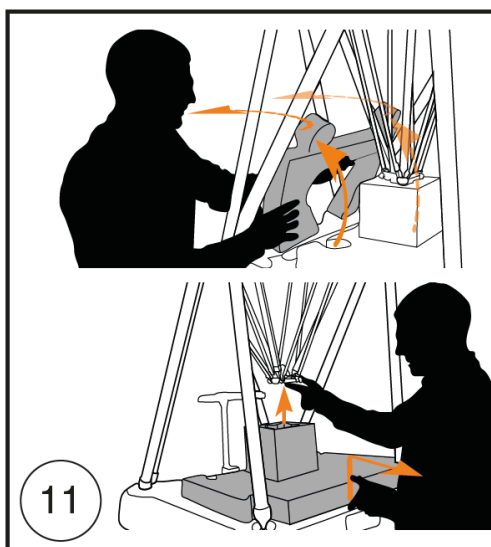
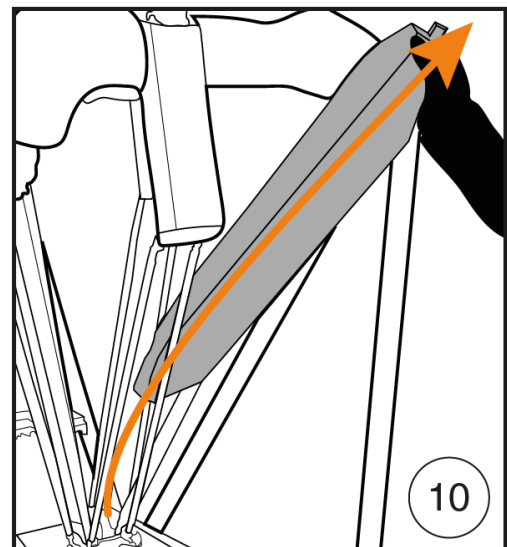
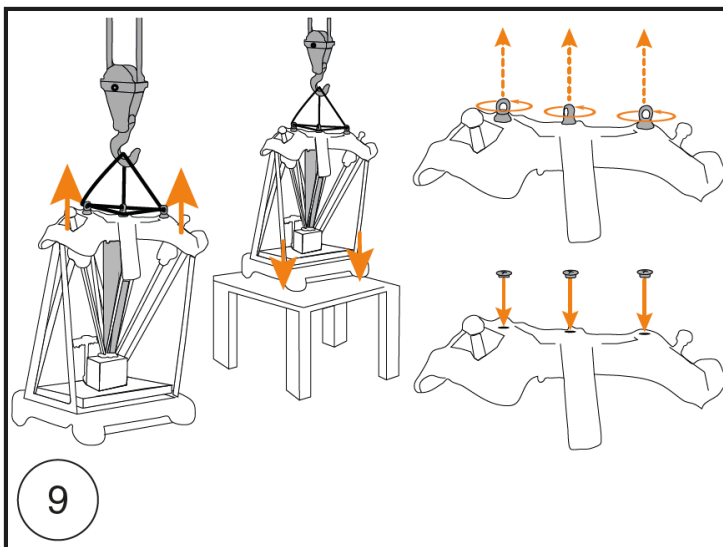
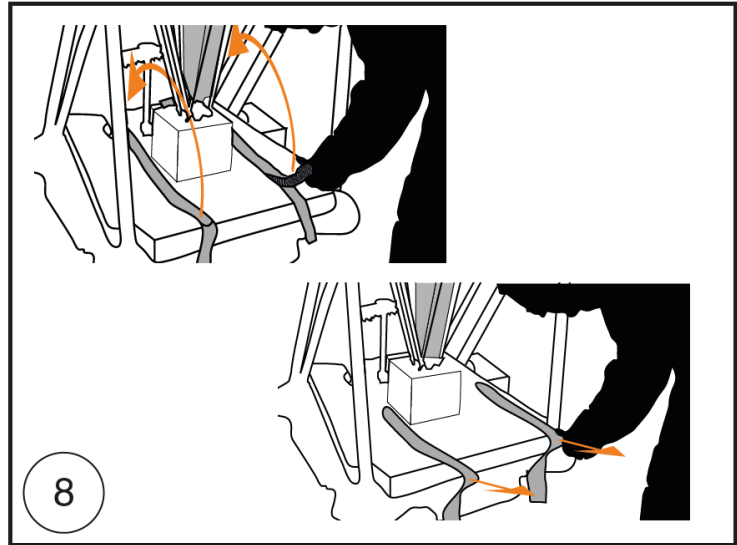
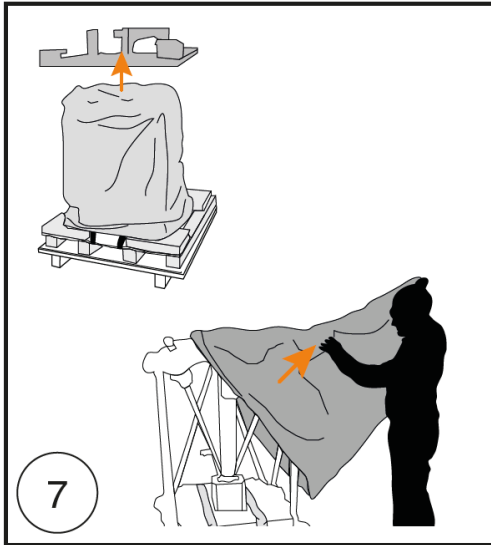






## Unboxing the Equator 500





## Installation

When the Equator has been removed from its transit packaging according to the instructions attached to the box, please follow the instructions in the following sections to start the system.

### Equator machine positioning

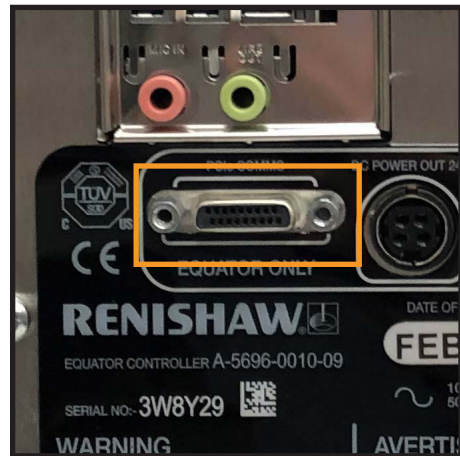
- The Equator system needs to be placed on a flat and sturdy surface. It is advised that a 1 m diameter clearance of other objects is established to avoid collisions.
- It is suggested that the monitor and the joystick (if fitted) are located near the machine so that operational information can be seen by the operator.

### Equator Controller positioning

- The controller can be placed on either side of the Equator as preferred. It can be placed either standing or lying down.
- Ensure that the fan intakes at the front and outlets at the rear do not become blocked in any way. Allow 10 cm distance between fan intakes and outlets to any surface.

## Connecting cables - Equator 300

### PClexpress cable



**W.1:** For further safety information, refer to the Equator Controller quick-start guide.

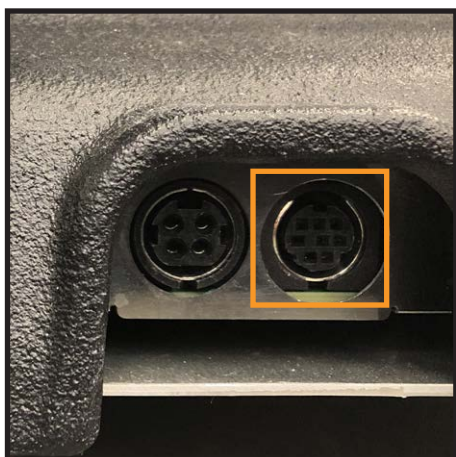
**W.2:** Be careful to connect the PClexpress cable in the correct orientation, as failing to do so can cause serious damage to the electronics. Refer to step 8.1.

**W.3:** Ensure all cables are connected prior to connecting to mains.

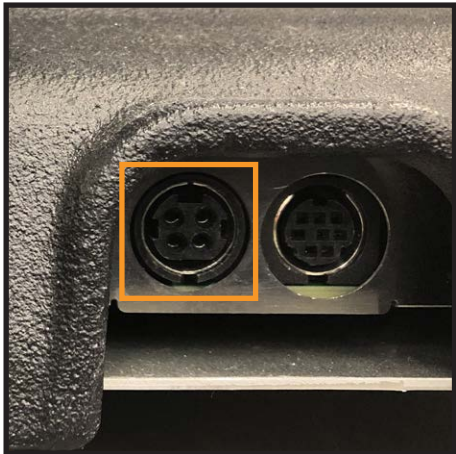




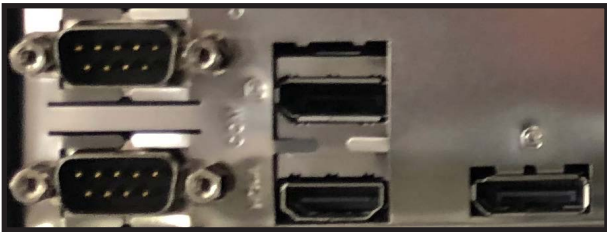
**MCUlite-2 / Stop button / Button Interface**  
(Button Interface only applicable to MODUS 1.x systems)



**Equator power cable**



**Monitor (only supplied with MODUS systems)**



**Mouse, keyboard (only supplied with MODUS systems)**





Dongle (if applicable)

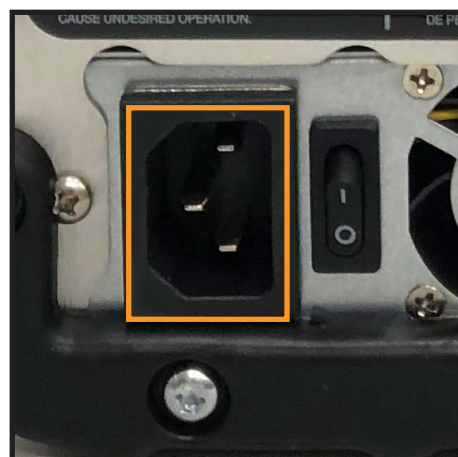


#### W.4: POWER OUTPUTS MUST NOT EXCEED THESE LIMITS

- (P1) 24 V  $\pm$  3% 4 A  
(MAX CONTINUOUS) 5 A (MAX PEAK)
- (P2) 48 V  $\pm$  3% 4 A  
(MAX CONTINUOUS) 8 A (MAX PEAK)
- (P1 & P2) COMBINED (48 V & 24 V)  
CONTINUOUS POWER OUTPUT MUST BE  
LESS THAN 300 W

**NOTE:** Both Ethernet ports (LAN 1, LAN 2) cannot be connected to the same network.

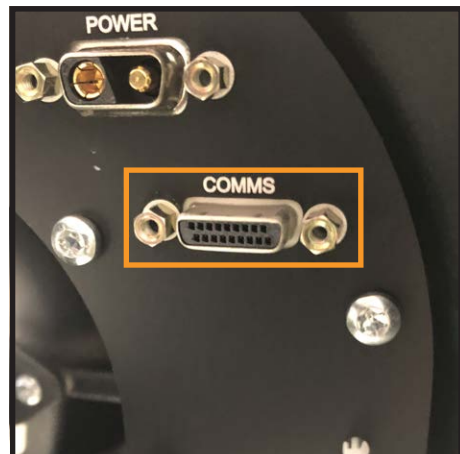
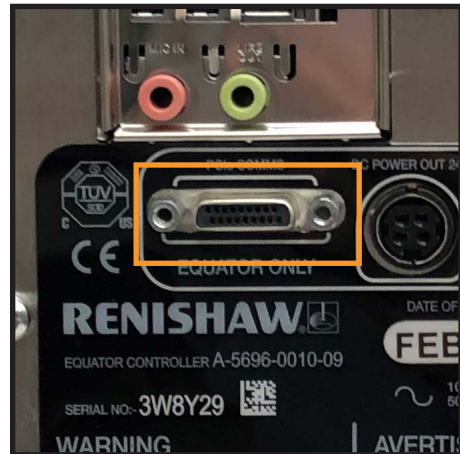
Connect monitor and Controller to mains power supply



## Connecting cables - Equator 500



### PClexpress cable

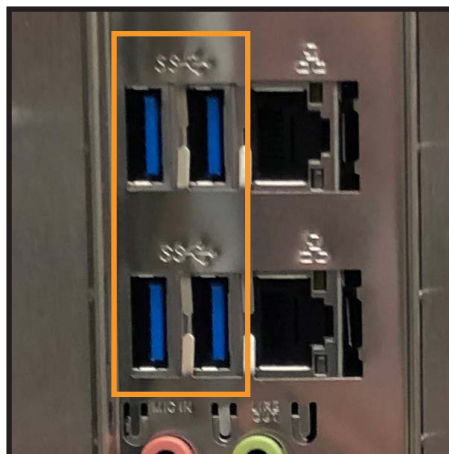


**W.1:** For further safety information, refer to the Equator Controller quick-start guide.

**W.2:** Be careful to connect the PClexpress cable in the correct orientation, as failing to do so can cause serious damage to the electronics. Refer to step 8.1.

**W.3:** Ensure all cables are connected prior to connecting to mains.

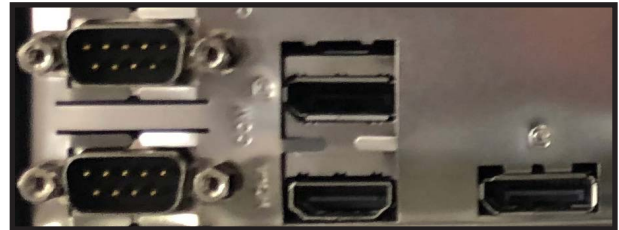
**MCUlite-2 / Stop button / Button Interface**  
(Button Interface only applicable to MODUS 1.x systems)



**Equator power cable**



**Monitor (only supplied with MODUS systems)**



**Mouse, keyboard (only supplied with MODUS systems)**





Dongle (if applicable)

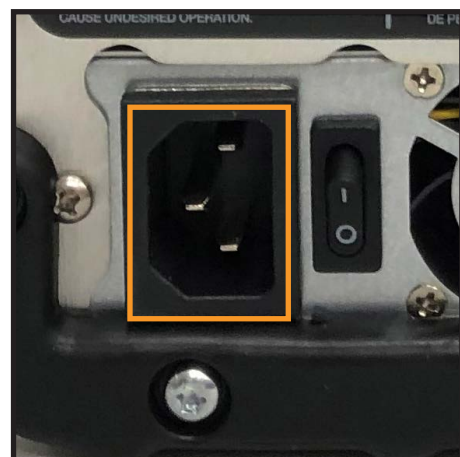


#### W.4: POWER OUTPUTS MUST NOT EXCEED THESE LIMITS

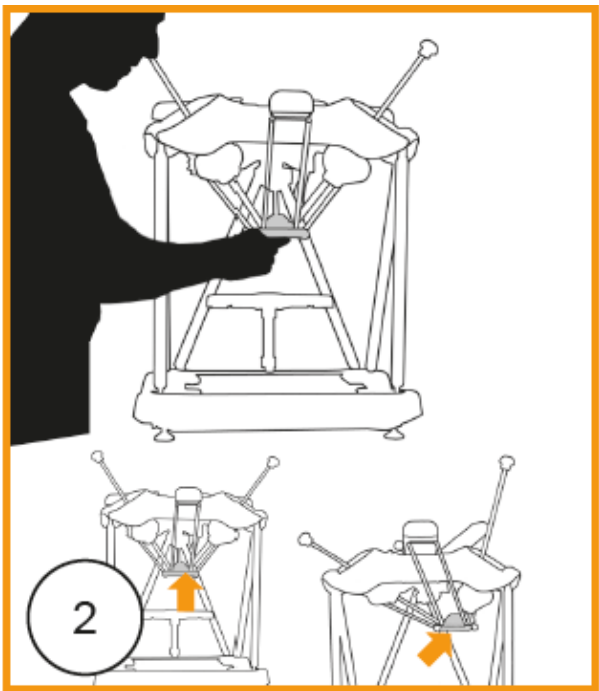
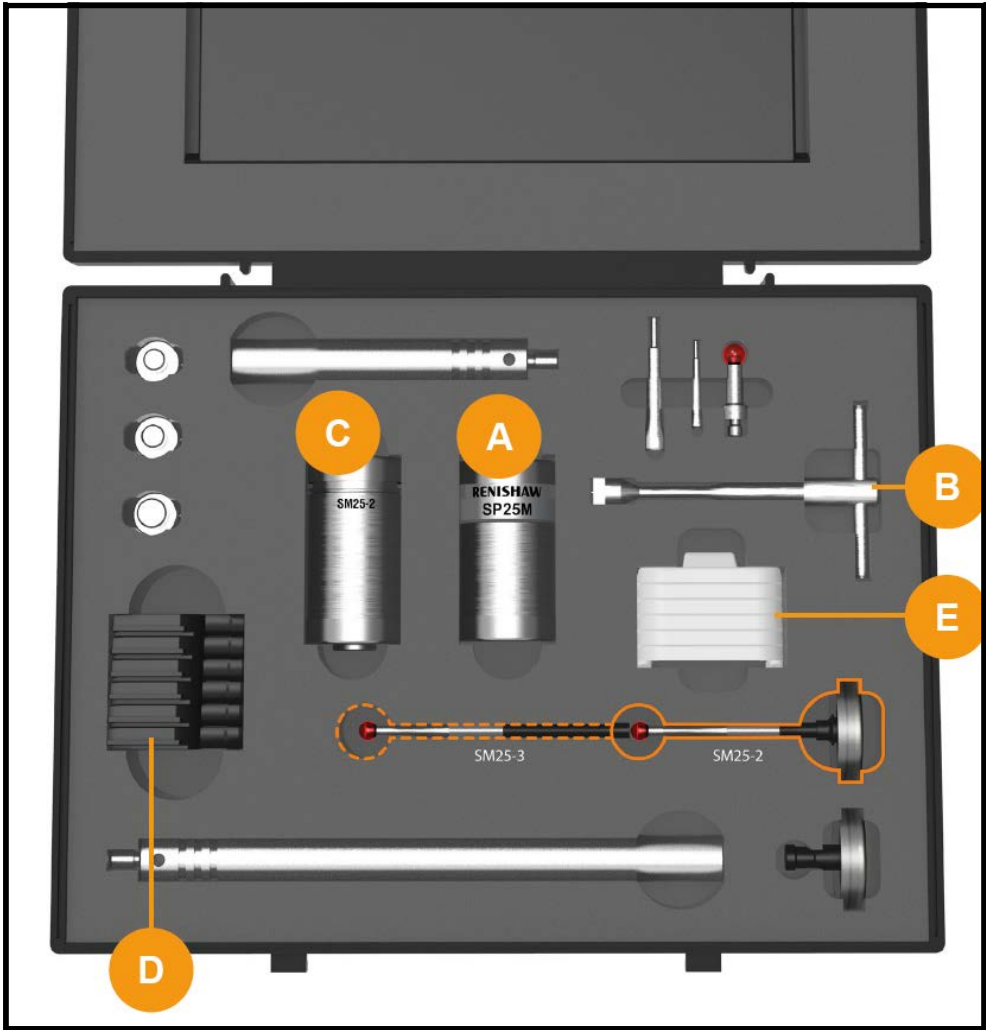
- (P1) 24 V  $\pm$  3% 4 A  
(MAX CONTINUOUS) 5 A (MAX PEAK)
- (P2) 48 V  $\pm$  3% 4 A  
(MAX CONTINUOUS) 8 A (MAX PEAK)
- (P1 & P2) COMBINED (48 V & 24 V)  
CONTINUOUS POWER OUTPUT MUST BE  
LESS THAN 300 W

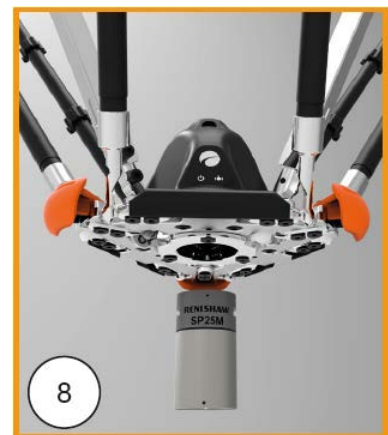
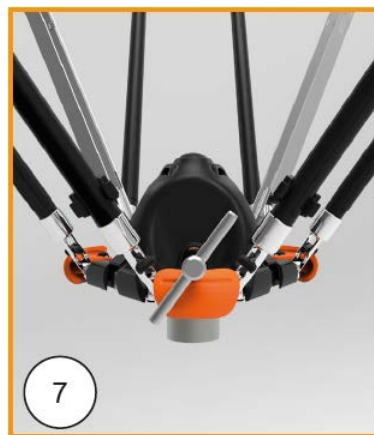
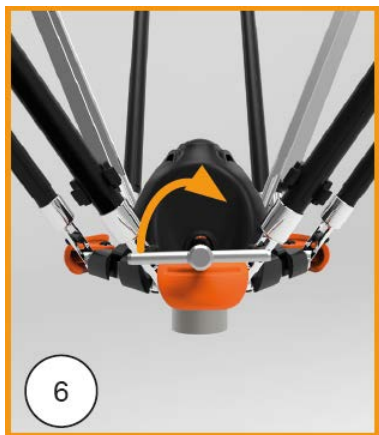
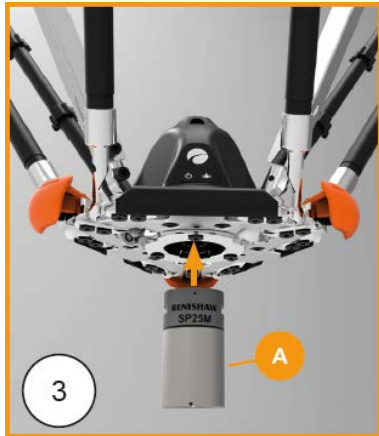
**NOTE:** Both Ethernet ports (LAN 1, LAN 2) cannot be connected to the same network.

Connect monitor and Controller to mains power supply



Connecting probe system - Equator 300



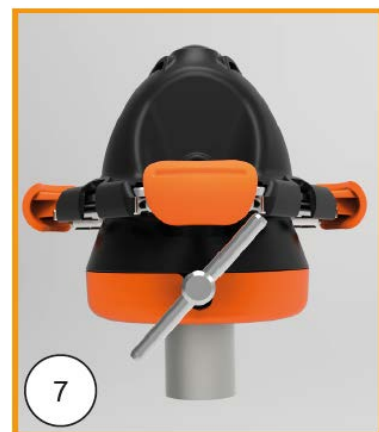




Connecting probe adaptor - Equator 500



## Connecting probe system - Equator 500



## Connecting styli

Attach the stylus to the probe module. The silver alignment marking should be towards you. There is a faint click when the magnets lock the kinematic coupling in place.



## Downloading Equator license and Software Suite

**NOTE:** Depending on the installation provider, the Equator gauging system will either arrive already licensed, or unlicensed and will either arrive with the latest software release or a previous release.

1. Note the serial number of your Equator machine, your Equator Controller and, if applicable, your dongle. The serial numbers can be found underneath the front support arm, on the back of the controller and on the side of the dongle, as shown below.



2. To obtain a licence, navigate to [www.renishaw.com/gaugingsupport/licencekey](http://www.renishaw.com/gaugingsupport/licencekey) on an internet enabled computer.
  - In the serial number fields, enter the relevant serial numbers.
  - Insert the end user's email address and details. Further detailed instructions and software update notifications will be sent to this email address.
3. Download the licence key file and save it onto a USB flash drive.

**NOTE:** Please click the “Save” button when prompted to download the licence file. The .equ format is Equator specific and can only be opened by the Equator Licensing/Updater tool.

To ensure you have the latest version of the Equator Software Suite and language packs, please visit: [www.renishaw.com/gaugingsupport/software-downloads](http://www.renishaw.com/gaugingsupport/software-downloads) regularly and follow the on-screen instructions.

- Download the Equator Software Suite and language pack files and save them onto a USB flash drive.

# Operation

## Stop button, joystick and Equator Button Interface

Depending on its specification, an Equator can be equipped with either a stop button, joystick or Equator Button Interface. The joystick contains an integrated stop button and therefore a separate stop button is not required.

---

**CAUTION:** If both a joystick and stop button are available to a system, only one can be connected to the system at a time unless you have a stop expander setup using the EQ-CM1.

Before connecting or disconnecting a stop button, joystick or Equator Button Interface, the system must be powered down correctly, otherwise damage to the circuitry is highly likely.

If manual mode is not selected, the operator should always engage the stop button before entering the Equator's working volume. This is especially important when the system can be operated remotely.

---

### Joystick - MCUIite-2

The joystick is used to move the probe within the working volume and is especially useful for programmers. Common tasks include moving the probe to the desired locations whilst programming, and manually measuring a component's initial alignment features before activating auto-alignment.

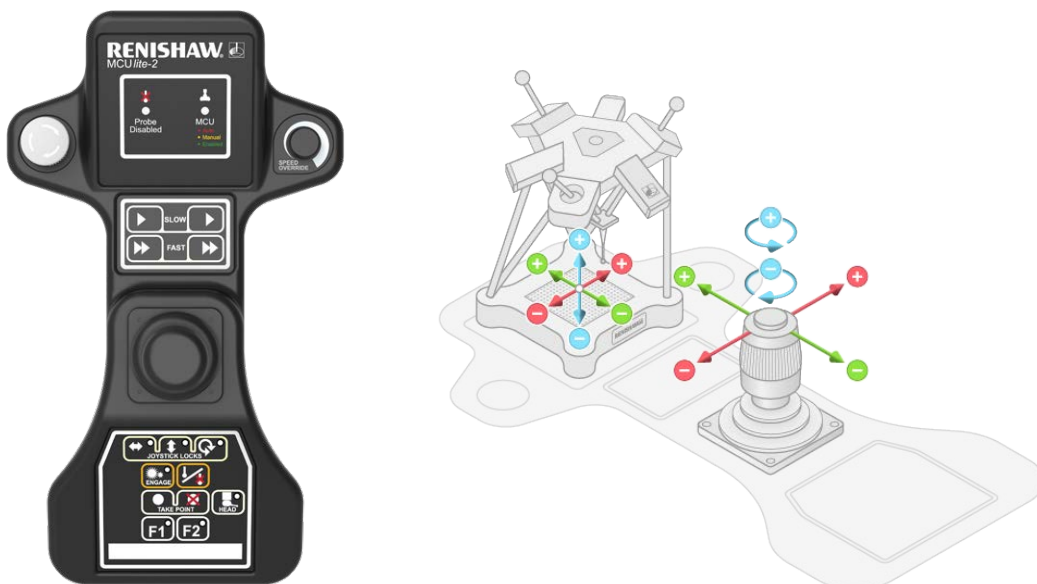
---

**NOTE:** To ensure good data quality, touch points should only be taken using the slow speed setting.

---

To move the probe in X (left to right) or Y (front to back) move the joystick in the desired direction while holding down either the Fast button or the Slow button to control the speed. To move in Z, twist the joystick clockwise to move the probe downwards, and anti-clockwise to move it upwards. Using these controls, the probe can be moved in any combination of axes at once, meaning that 3D vector movements are possible.

If you drive the stylus into an artefact when using the joystick, this will result in a probe overdeflection error. You will need to reset the probe in the software.



## Stop button

Depending on the specification of the Equator, the stop button is either located on the left hand side of the base or is an integral component of the joystick. The stop button is intended to be used to reduce the risk of collisions by allowing the user to stop the motion of the machine.

The stop button is disengaged by twisting the stop button clockwise.

Following the engagement of the stop button the machine will not restart automatically. To restart, disengage the stop button, clear the error using the software and the Equator should be enabled and ready for inspection

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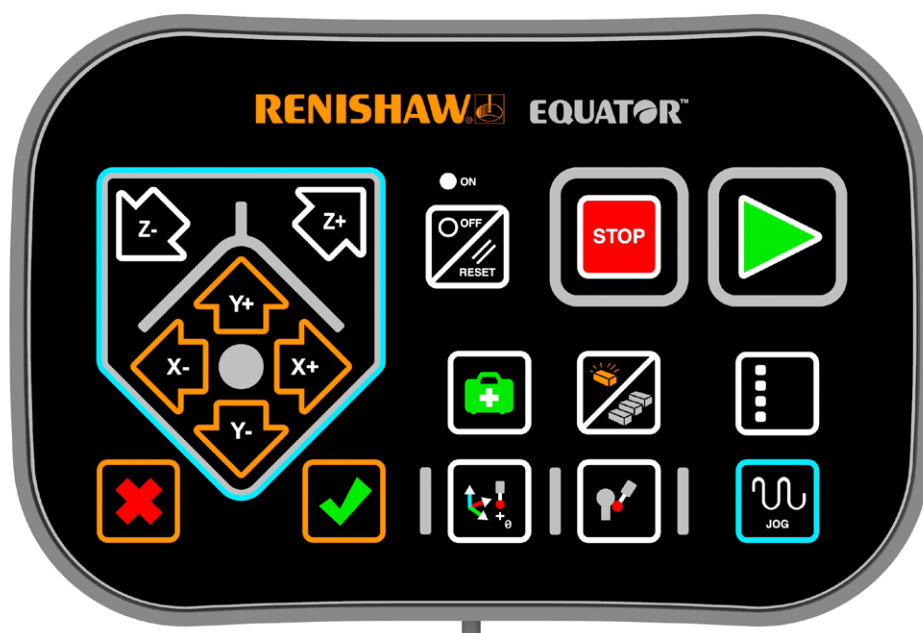
**NOTE:** When the stop button is engaged, the struts remain powered but the motion is stopped.

---



## Equator Button Interface (MODUS 1.x systems only)

The Equator Button Interface allows the operator to control the Equator using simple push-button controls. It removes the need for a keyboard and mouse.

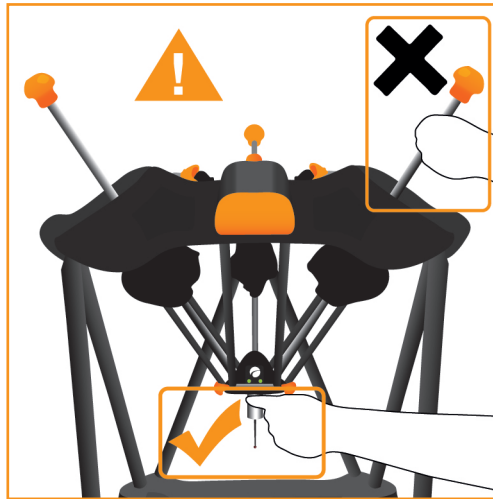




## Moving the platform manually (Equator 300 only)

**NOTE:** Only move the platform manually if an error has caused Equator to stop with the stylus in a region where the joystick and manual mode button do not work.

- Before entering the working volume, activate the stop button. This ensures that the machine will not start to move automatically.
- To move the platform, hold the probe close to the underside of the platform and then reposition the machine as required.
- Be careful not to disengage the module from the probe body. If the module is disconnected, reconnect the module making sure that the alignment marks are aligned correctly and recalibrate the probing tools. Once clear of the working volume, disengage the stop button by twisting it and clear any errors.



### Hold mode

When the stop button is engaged, hold mode is activated and the machine status light on the floating platform flashes amber. In hold mode, a slow, servo assisted movement of the platform will be allowed. The probe should be held close to the platform to reposition in the desired direction. The module and stylus should not be used to move the platform.

If the platform is moved outside of the working volume, braking takes over and the platform will drop slowly under its own weight. The platform needs to be moved back inside the working volume, the stop button needs to be released and the machine needs to be reset using the software before the system can be used again.



## Workpiece and fixture plate loading

### Workpiece loading

When loading a part into the working volume, first make sure that the probe is in a safe position.

The loading and unloading of parts can be achieved in several ways. Either the fixture can be released and the part exchanged within the working volume or, alternatively, the fixture plate can be removed from the kinematic positioning for loading/unloading external to the machine.

In order to increase the efficiency of use, a number of pre-loaded fixture plates could be queued for inspection. Additional fixture plates are available for purchase as accessories.

Please see [www.renishaw.com/equator-accessories](http://www.renishaw.com/equator-accessories) or contact your local Renishaw representative.

When loading a fixture plate, ensure that your hands do not get trapped under the plate by making use of the hand holes in the base casting (see below).



---

**NOTE:** Gently attempt to move the plate once positioned. There should be no movement if the plate is correctly loaded.

---

### Fixture plate location

The repeatable positioning of the fixture plate on the Equator's base casting is controlled by the kinematic locations found on the base casting and on the underside of the fixture plate.

Use of the kinematic location minimises the requirement to carry out an initial location of a component within the part program, thereby improving the throughput of components.

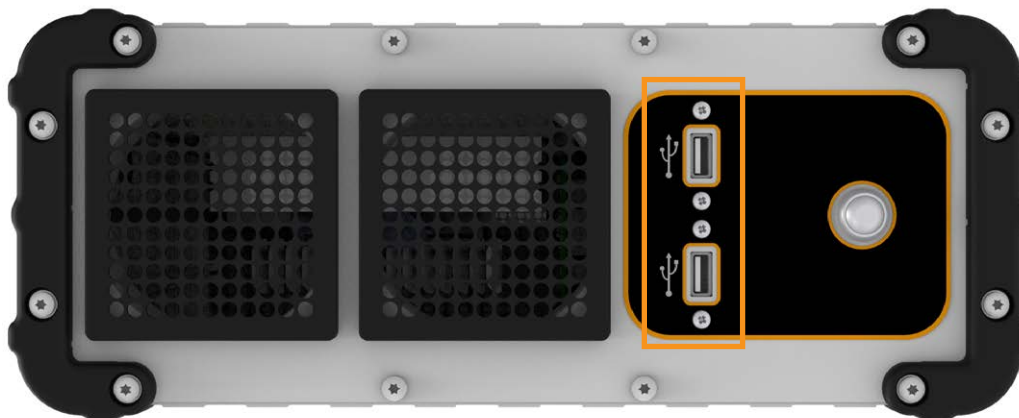
## Starting the system

- Switch on electrical power to the display (VDU) and the controller unit. The software will start to load automatically and the start-up screen will be displayed. Please wait until all the software has loaded before you continue.

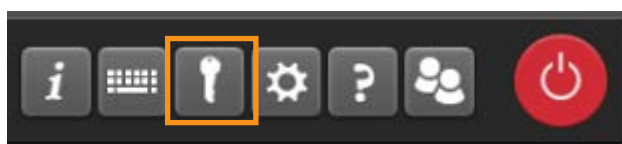


## Activating a system license

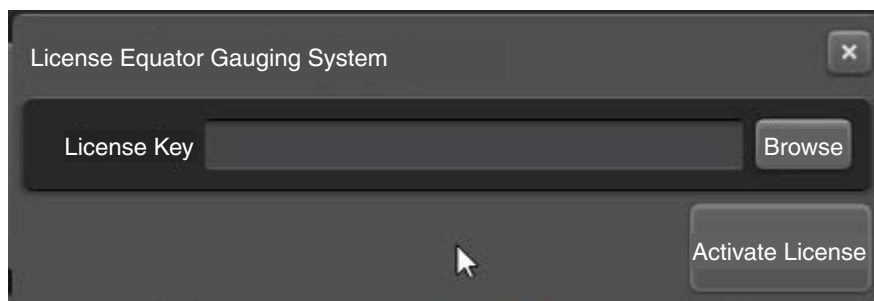
- Once you have downloaded the system license file from the Renishaw website, plug the USB flash drive containing the license file into one of the controller USB ports.



- Click on the key icon at the bottom right hand corner of the screen.



- Browse to the licence key file on the USB flash drive.



- Click "Activate licence".



## System shutdown

---

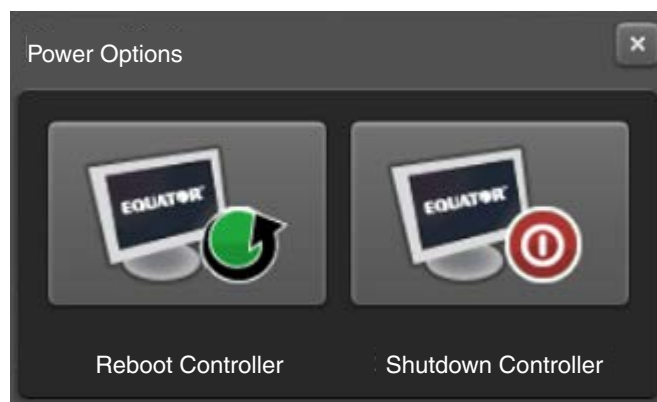
**NOTE:** Prior to shutting down the system, if there is a fixture plate fitted to the system, it must be removed. If you are unable to remove the plate due to the location of the probe assembly, move the probe assembly clear, then remove the fixture plate.

---

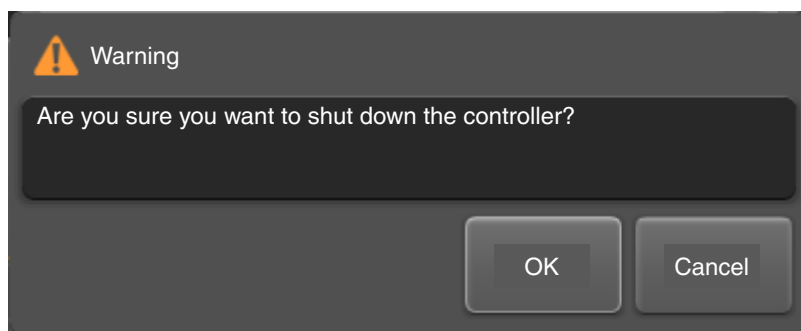
- To shutdown the system, click on the “system shutdown” button within the taskbar.



- Click on “Shutdown Controller” button.



- The following message is displayed (Are you sure that you want to shutdown the Controller?).
- Click “OK” and the system will shutdown.

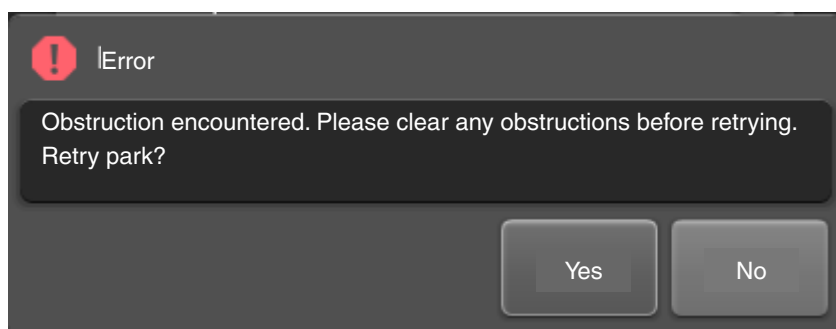


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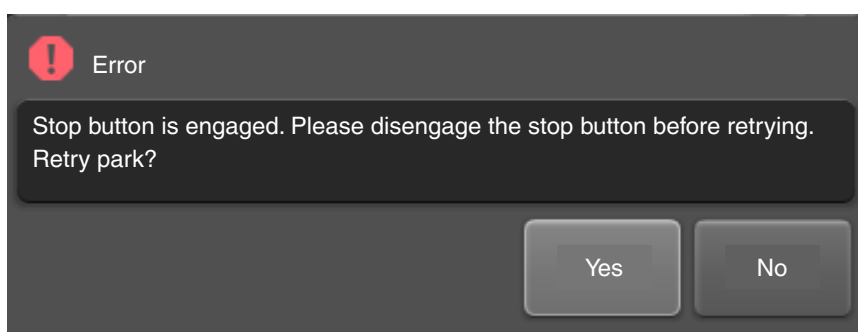
**NOTE:** If park is enabled and the docking mechanism is present, the Equator 300 system will park prior to shutting down.

---

- If a collision with the part occurs when parking, the following message is displayed (Obstruction encountered. Please clear any obstructions before retrying).
- Clear any obstructions and either “Retry Park” or “Continue without Park”.



- If the stop button is engaged when parking, the following message is displayed (Stop button is engaged. Please disengage Stop button before retrying).
- Disengage the stop button and either “Retry Park” or “Continue without Park”.



# Cleaning and maintenance

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**NOTE:** The Equator and the Equator controller have no user-serviceable parts inside.

---

## Cleaning

The Equator 300 cleaning kit (A-5504-9055) provides everything needed to ensure the clean and reliable running of an Equator machine. The cleaning kit includes replacement dust filters and cleaning products which have been tested and proven as non-abrasive and non-corrosive.

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**CAUTION:** Do not use solvents.

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## Maintenance

Following the simple maintenance procedures given below will prolong the operational life and provide continued high performance of the system. The user should determine the frequency of inspection and maintenance actions according to the conditions of use.

The Equator machine has no user-serviceable parts.

The Equator controller has fan filters needing regular replacement to ensure satisfactory cooling of internal parts. The Equator controller has no internal serviceable parts. In the event of a problem, please contact your supplier for assistance. An Equator controller Fan Filter Kit (A-5696-0120) containing 12 fan filters can be purchased from Renishaw ensuring 6 months worth of filters for high contamination environments.

Repair and replacement of parts should only be carried out by a Renishaw representative. Renishaw offers a maintenance contract which provides overnight Repair-By-Exchange (RBE) and the option to have a consignment unit on site.

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**CAUTION:** Always adhere to the instructions given in the Safety information section of this guide. Failure to do so could adversely affect the performance of the system and/or lead to personal injury.

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## **SP25 maintenance**

SP25 maintenance is described in the SP25 user guide.

## **TP20 maintenance**

TP20 maintenance is described in the TP20 user guide.

## **Styli maintenance**

Stylus balls, threads and mating faces should be cleaned using a proprietary cleaning cloth or solvent. Stylus balls should be regularly inspected for damage or 'pick-up' of component material (a problem sometimes encountered with continuous scanning). Renishaw offers a range of ball materials suited to scanning of different component materials. See Renishaw's styli catalogue (part number H-1000-3200), which can be downloaded from [www.renishaw.com/styli](http://www.renishaw.com/styli).

## **Connector maintenance**

Regular checks should be made to make sure that the electrical connectors are properly located.

## **Controller fan filter maintenance**

The fan intakes on the front of the Equator Controller have filters to prevent dust and other particles from entering. These filters should be replaced regularly to prevent overheating of the controller.

When replacing the filters, ensure that the controller is powered down and unplug the power supply from the mains. Carefully release the snap fit clips on the covers to reveal the filters. Once the filters are replaced, locate the covers and clip back into position. A slight click may be audible when the covers locate.

## **Liquid spillage**

- Reasonable measures should be taken to protect the system (machine and controller) from liquid spillage.
- If a spillage occurs, exercise caution when unplugging the power connector from the wall socket.
- Soak and wipe up the liquid using a dry, lint-free cloth.
- Inspect the system to see if any liquid ingress has occurred. If not, the power supply can be reconnected.

If liquid ingress occurs to the machine/controller, this is a potential electrical hazard, do not reconnect the power connector. Please send the unit back to the supplier for replacement at customer's cost. This type of damage is not covered by the warranty or RBE scheme, so please ensure that the machine/controller is given the protection required for the environment.

# Diagnosing Faults

## Equator 300 lights and signals



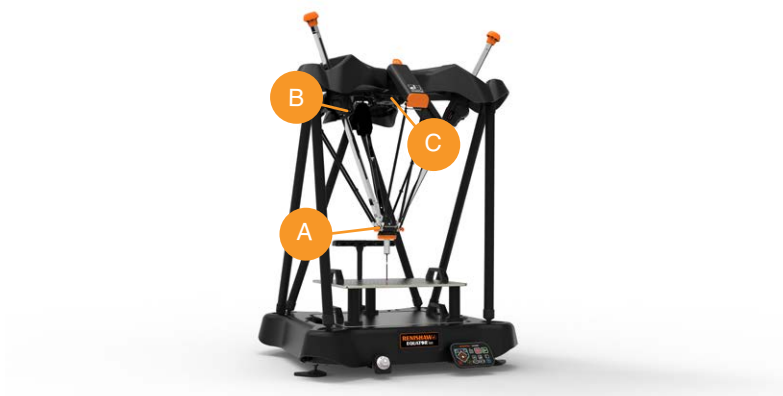
Left LED	
Grey - Off	No power
Solid red	Machine disengaged - fault state
Red flashing	No communications
Solid amber	Machine disengaged - no fault state*
Amber flashing	Hold mode engaged
Solid green	Machine engaged



Left LED	
Grey - Off	No power
Solid red	Probe fault / over range
Red flashing	No probe present
Solid amber	N/A*
Amber flashing	N/A
Solid green	Machine engaged

\*If both LEDs are solid amber, the machine is initialising.

## Equator 500 lights and signals





**A** Floating platform

**B** Drives

**C** Hub



Colour	Platform left 	Platform right 	Drive	Hub
<b>Off</b>	No power	No power	No power	No power
<b>Solid red</b>	Machine disengaged/ error	Probe fault	Machine disengaged/ error	Machine disengaged/ error
<b>Red flashing</b>	No communications	No probe present	No communications	N/A
<b>Amber flashing</b>	N/A	N/A	N/A	Update failed Machine initialising
<b>Solid amber</b>	Machine initialising	Machine initialising	Machine initialising/ disengaged	Update failed Machine initialised
<b>White</b>	N/A	N/A	Machine engaged	Machine initialised
<b>White pulse</b>	N/A	N/A	Machine engaged with idle brake	Machine initialising
<b>Solid green</b>	Machine engaged	Machine engaged	N/A	N/A

## Error messages and common errors

### Error messages

Messages from all Equator software will be displayed in Organiser. The first warning messages will be displayed with an error type and description, ending with a standard message "Contact your supervisor". A second message informs you that the inspection failed and continued attempts were aborted. When confirming this last message, errors are reset and the inspection can be re-started.

For programmers working directly with MODUS, the messages will be displayed directly by the component that is in an error state. When using a MODUS system, if the error came from EquatorServer, the error must be cleared by clicking the "clear all errors" button in the commands tab. To stop the error from recurring, the user will have to make the necessary adjustments, e.g. reprogram a collision event so there is more clearance, change expected deflections of the probe, reduce speeds etc.

### Common errors

Below are listed some of the physical faults which might occur and their solutions.

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**NOTE:** Some solutions require administrator access.

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Physical fault	Cause	Solution
The stylus head has come loose.	Stylus crash.	Use the stylus tool to retighten the head and recalibrate.
Stylus bent.	Stylus crash.	Use a new stylus and recalibrate.
Stylus vibrates when moved.	Module broken.	Replace module.
System fails to collect touch points.	Probe deflection incorrectly set.	Move the probe into free space and reset the probe. Check the deflection is less than 4 microns by selecting UCCServer Equator, and then select Advanced > Equator Server > CMM Controller > Generic > Probe Deflection and check the XYZ deflections. If too high, recalibrate the probe.
Joystick not working.	Loose connection.	Shut down the system, disconnect the controller from mains, check that the joystick plug is securely in its socket.
Unexpected motion in manual mode.	Removal of the module.	Disengage manual mode, engage the physical stop button, refit the probe module, disengage the stop button again and recalibrate the probe.
Unexpected motion in manual mode.	Removal of the stylus.	Disengage manual mode, engage the physical stop button, refit the stylus, disengage the stop button again and recalibrate the probe.

## Dismantling and Disposal

1. Use the “Configure brakes for transport” app available on the controller (ask Renishaw support for location).
2. Remove any fixture plates from the Equator.
3. Disconnect all power supplies.
4. Unplug the Equator system from the controller.
5. Disconnect the screen, mouse and keyboard from the controller.
6. Unplug the stop button.
7. If returning the system to Renishaw as part of the RBE scheme, repackage the system using the reverse of the unpacking instructions. If not, dispose of the system according to the WEEE regulations (see the WEEE information section on page 13).

[www.renishaw.com/gauging](http://www.renishaw.com/gauging)



#renishaw



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Original language instructions

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