



# SIXFIX™ HEXAPOD OPERATIVE TECHNIQUE

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## **DEVICE DESCRIPTION**

The SixFix™ Hexapod is a multilateral circular external fixation system consisting of two (2) rings, one (1) ring and one (1) foot plate, or two (2) foot plates (circular external supports) and six (6) variable-length struts. Gradually adjusting the lengths of the struts in relation to one another alters the orientation of the rings and, consequently, the bone segments connected to the rings by half-pins and wires during the treatment period in order to achieve the patient's treatment goals.

## **INDICATIONS FOR USE**

The SixFix Hexapod is intended to be used for post-traumatic joint contracture which has resulted in loss of range of motion; fractures and disease which generally may result in joint contractures or loss of range of motion and fractures requiring distraction; open and closed fracture fixation; pseudarthrosis of long bones; limb lengthening by epiphyseal or metaphyseal distraction; correction of bony or soft tissue deformities; correction of bony or soft tissue defects; joint arthrodesis; infected fractures or nonunions.

## **CONTRAINDICATIONS**

1. Physiologically or psychologically inadequate patient.
2. Possibility for conservative treatment.
3. Failure to obtain patient's consent.

Conditions presenting an increased risk of failure include:

- Active infection
- Inadequate skin, bone or neurovascular status
- Irreparable tendon system
- Growing patients with open epiphyses
- Patients with high levels of activity
- Fevers and white blood cells
- Obesity

## **MRI SAFETY INFORMATION**

The SixFix Hexapod has not been evaluated for safety and compatibility in the MR environment. It has not been tested for heating, migration, or image artifact in the MR environment. The safety of the SixFix Hexapod in the MR environment is unknown. Scanning a patient who has this device may result in patient injury.

### **RADIOGRAPH GUIDANCE**

Care should be exercised when imaging the bone to be aware of potential obscuring or shadowing from metal components. Be aware that the fixator and fixation elements may produce artifacts that could cause the the fracture site to be difficult to visualize. Should clear, unobstructed images of the fracture site not be available within the set of patient radiographs, it is recommended that the user save and exit the current consultation. The saved consultation may be continued following the acquisition of an acceptable set of radiographs.

## **PRODUCT DESCRIPTION**

The SixFix Hexapod is a circular external fixator based on Ilizarov principles. The working segment of this device is a hexapod made up of six struts each capable of adjusting independently to variable lengths and offering 6 degrees of freedom. The struts are capable of joining the following configurations:

- Two (2) rings,
- One (1) ring and one (1) foot plate, or
- Two (2) foot plates.

The lengths of the struts relative to one another determine the position of the rings in space. Because the rings are attached to bone segments, their position indirectly determines the position of those bone segments. The struts are gradually adjusted during the treatment period in order to achieve the patient's treatment goals. Each strut can be independently lengthened or shortened relative to the rest of the frame to provide six different axes of movement. The rings' positions are adjusted either rapidly or gradually in precise increments to perform bone segment repositioning in three-dimensional space. The SixFix Hexapod provides the surgeon a valuable tool to correct difficult congenital deformities and trauma cases.

The design of the SixFix Hexapod enables its Strut Assembly to adapt to any length required without undergoing a strut replacement from the initial application of the SixFix Hexapod on the patient to the point at which the patient's fracture is completely healed. The SixFix Hexapod accomplishes this by virtue of adding a Strut Screw Add-on when the Base Strut Screw has reached 200mm, the length limit of the Strut with the Base Strut Screw. Each SixFix Hexapod Strut is capable of lengthening to 300mm by adding a Strut Screw Add-on to the Base Strut Screw.

The SixFix Deformity Analysis and Correction Software (DACS) is an optional, PC-based software component and can be used with the SixFix Hexapod. The final output is a deformity correction prescription which details adjustments required for the treatment of traumatic or reconstructive deformities in the long bones of the upper and lower extremities including the foot and ankle. When used as instructed, the DACS outputs are equivalent to performing accurate manual calculations.

**SIXFIX HEXAPOD OVERVIEW**

The SixFix Strut Assembly integrates six (6) individual SixFix Hexapod struts into one component to provide stability for the Hexapod Rings and Footplates. Six (6) Ring Mounts connect the struts to the Rings/Footplates to produce a construct assembly that is ready to apply to any patient without having to be built one strut at a time like current designs.

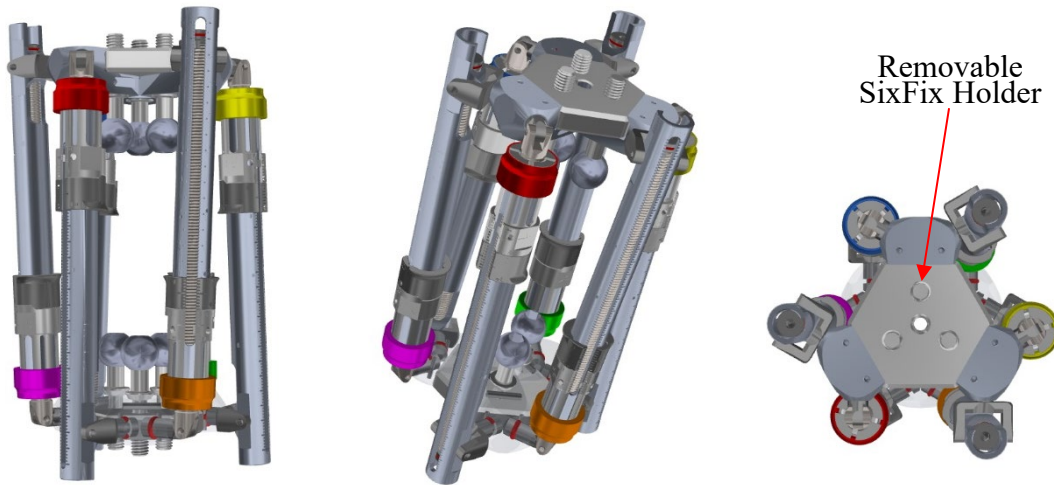
The SixFix Hexapod design improves safety and effectiveness by eliminating the potential errors of current designs, such as:

Current designs	SixFix Solutions
Selecting a strut with the incorrect length;	<b>One size strut capable of lengths from 100mm to 300mm in a pre-assembled package.</b>
Placing a strut in the incorrect position in relation to the other struts;	<b>The SixFix Strut Assembly comes pre-assembled in the proper sequence.</b>
Rotating the frame in an incorrect orientation to the affected bone.	<b>The DACS detects the Radiopaque Fiducial Markers in the radiograph regardless of their position relative to the imaging device.</b>
Applying a strut ID band on the wrong strut can cause an error in strut adjustment.	<b>The SixFix Strut Assembly is manufactured with both color and numbering as an integral part of each strut.</b>

## UNFOLDING THE SIXFIX STRUT ASSEMBLY

You will notice right away that the SixFix Hexapod is a very different design than any other hexapod device you may have used. The SixFix Hexapod is pre-assembled in a compact, folded, easy-to-handle unit.

**Figure 1: Folded SixFix Strut Assembly**

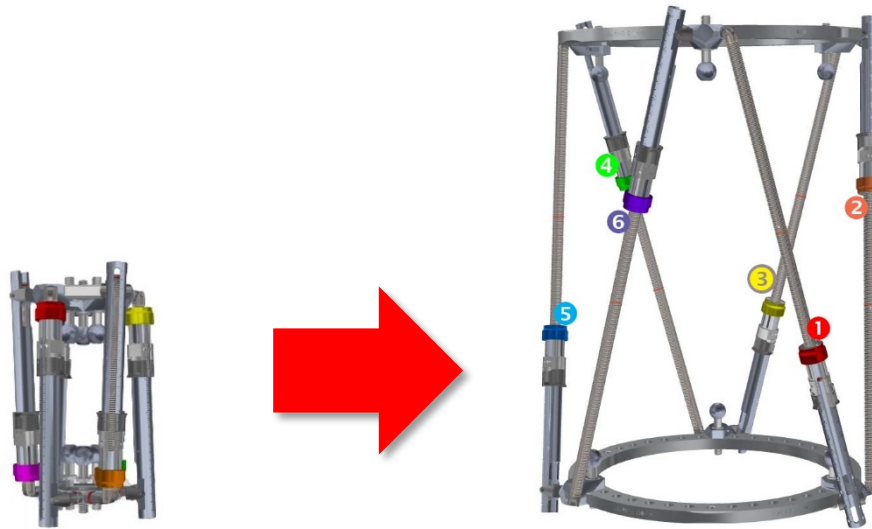


The SixFix Strut Assembly consists of 6 struts connected by ring mounts. The SixFix is ready to be attached to the rings the surgeon has selected for this patient. The SixFix Hexapod saves you time and effort by quickly and easily transforming from the compact unit to a fully functional frame

Without any additional components, the SixFix Strut Assembly comes out of the tray capable of strut lengths from 100mm to 200mm. The simple attachment of one (1) Strut Screw Add-on extends the maximum strut length to 300mm. This unique product feature means that no SixFix strut ever requires an exchange because of length limitations. In addition, there is no need to go through the meticulous, time-consuming process of selecting and placing specific size struts with which to build your frame. The SixFix Hexapod saves you time and effort by quickly and easily transforming from the compact unit to a fully functional frame.



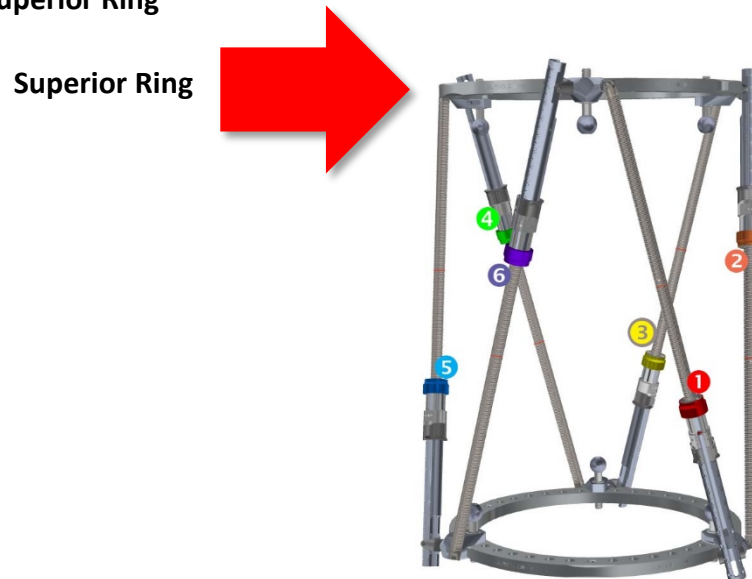
**Figure 2: SixFix Strut Assembly Expanded**



The folded SixFix Strut Assembly can attain strut lengths of up to 200mm. The addition of one (1) Strut Screw Add-on extends the maximum length to 300mm.

### **SELECTING AND CONNECTING THE ANTERIOR/SUPERIOR RING MOUNT**

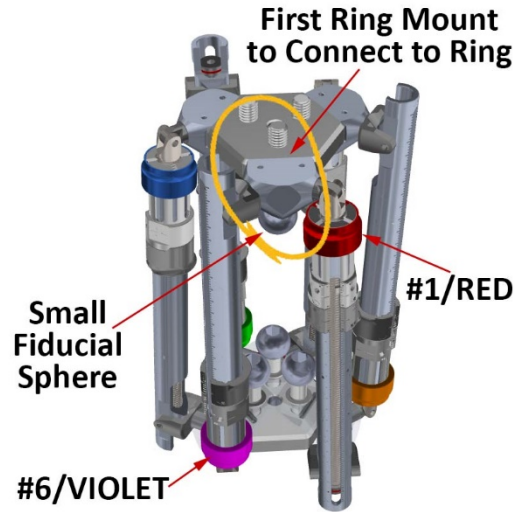
**Figure 3: The Superior Ring**



Begin the process of attaching the rings with the superior ring.

Remove the SixFix Hexapod from the holder one Ring Mount at a time to attach to your ring of choice starting with the Ring Mount connecting the #6/VIOLET Strut and the #1/RED Strut. This Ring Mount holds the small Fiducial Sphere that should be placed in the anterior/superior threaded hole of the superior ring.

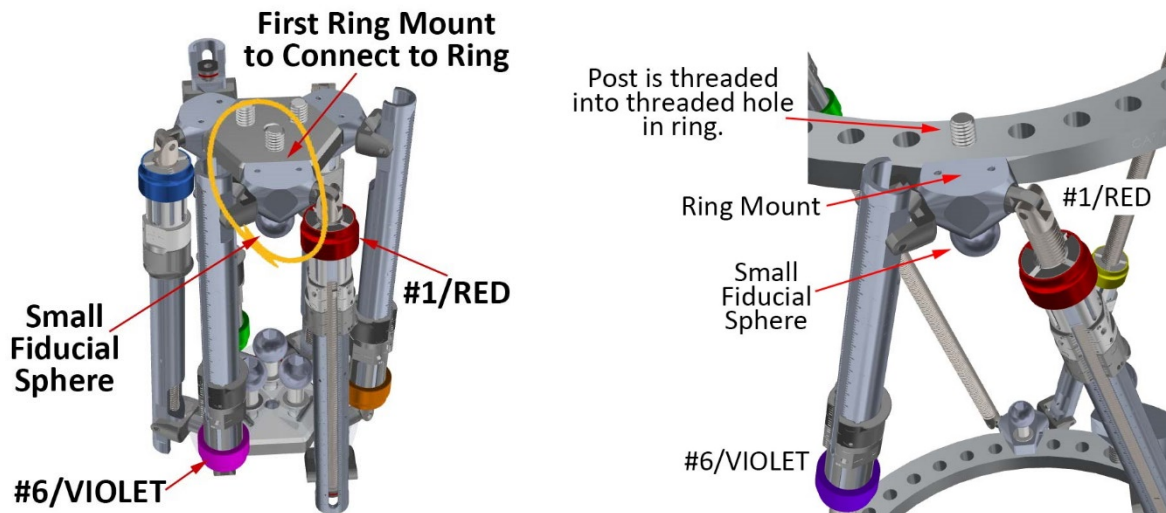
**Figure 4: Identifying the First Ring Mount to Connect**



Locate the small fiducial sphere that is adjacent to the #1/RED strut. This will be the first Ring Mount connected to the superior ring.

The first Ring Mount to attach to the superior ring is the Ring Mount connecting the #6/VIOLET and #1/RED struts. Look for it next to the RED Locking Collar. It holds the small fiducial sphere that is placed in the anterior/superior position on the superior ring.

**Figure 5: Initial Ring Mount Threaded into Anterior Threaded Hole in the Superior Ring**

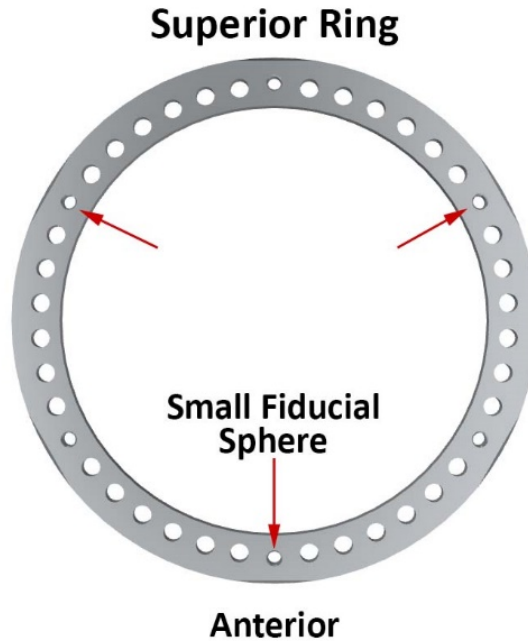


The first Ring Mount to attach to the superior ring is the Ring Mount connecting the #6/VIOLET and #1/RED struts. This specific Ring Mount is placed in the ANTERIOR threaded hole.

Each Fiducial Sphere is attached to a 6mm threaded post that enters threaded holes in the superior ring from below and into the inferior ring from above. Place the Ring Mount in every other threaded hole in their respective rings.

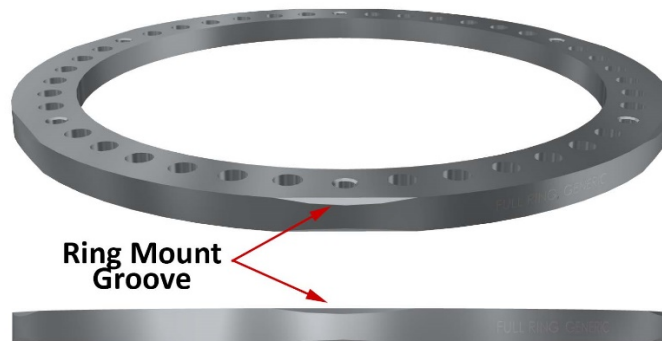
This post is hand-tightened into one of the six threaded holes in the ring perimeter. A hex in each Fiducial Sphere enables the connection to be tool-tightened when the SixFix Hexapod frame is fully assembled.

**Figure 6: Superior Full Ring Showing Threaded Holes**



The arrows indicate the threaded holes used to secure the Ring Mounts in the superior ring. Notice that the Ring Mount with the Small Fiducial Sphere is attached to the anterior hole.

**Figure 7: Finding the Ring Mount Groove on a Full Ring**



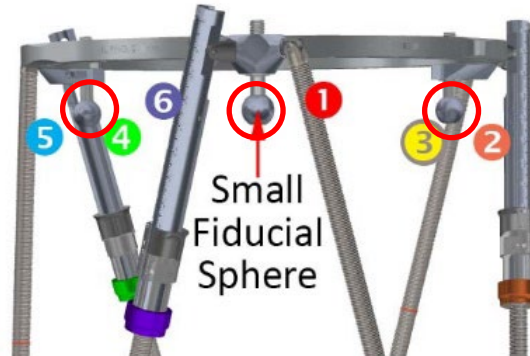
Each threaded hole is flanked by a Ring Mount Groove that provides a stable attachment for the Ring Mount. The Ring Mount Groove also serves as a convenient visual marker for the six (6) threaded holes.

Each threaded hole is flanked by a Ring Mount Groove that provides a stable attachment for the Ring Mount. The Ring Mount Groove also serves as a convenient visual marker for the six (6) threaded holes.

### CONNECTING THE REMAINING RING MOUNTS TO THE SUPERIOR RING

The remaining two (2) superior Ring Mounts are threaded into alternating threaded holes in the superior ring.

**Figure 8: Ring Mounts on the Superior Ring**



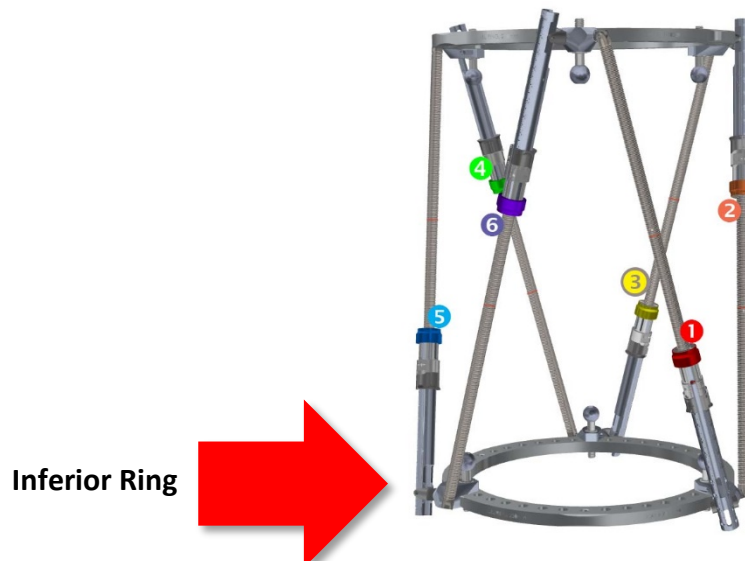
The three (3) Ring Mounts are threaded into the superior ring

Thread the two (2) remaining Ring Mounts into the threaded holes in the superior ring.

### CONNECTING THE RING MOUNTS TO THE INFERIOR RING

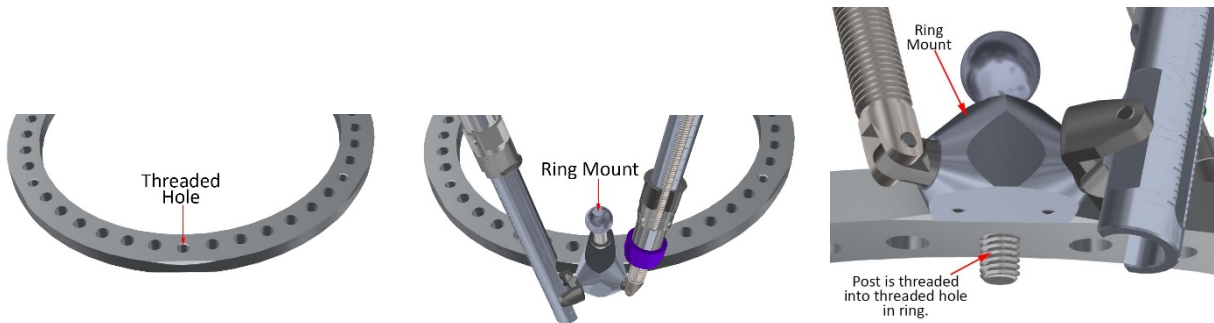
Remove the remaining Ring Mounts from the Holder and select one of the Fiducial Bolts to thread into a threaded hole. Note that a threaded hole will be skipped between each Ring Mount.

**Figure 9: The Inferior Ring**



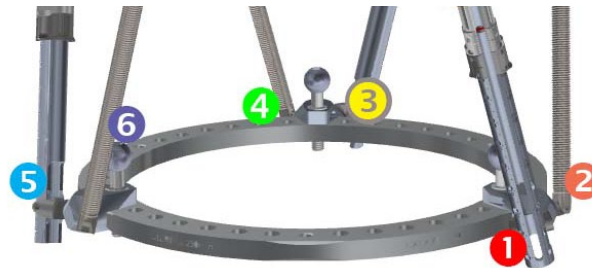
Prepare to secure the Ring Mounts to the inferior ring by removing the remaining Fiducial Bolts from the holder.

**Figure 10: Securing the Ring Mount in an Inferior Ring**



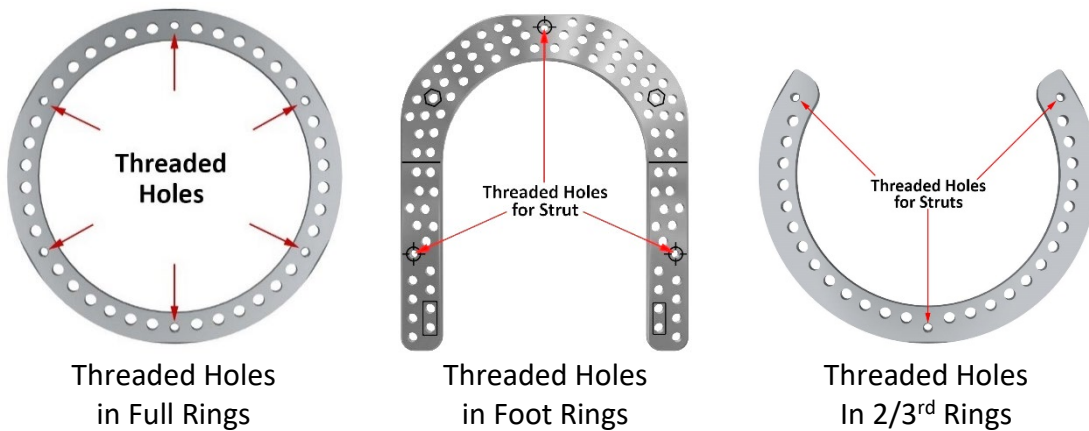
Ring Mounts are connected superior to the inferior ring by threading the Fiducial Bolt into the threaded holes of the inferior ring. Notice that the Ring Mount is superior to the ring.

**Figure 11: Ring Mounts on the Inferior Ring**



Ring Mounts are threaded into the threaded holes in the inferior ring. The Fiducial Spheres are superior to the inferior ring.

**Figure 12: Ring Mount Locations on Foot Rings and 2/3rd Rings**



**FINAL TIGHTENING OF THE RING MOUNTS**

After both rings are attached to the Strut Assembly, final tightening is achieved using the 76-10012 5mm Ball End Hex Driver to engage the hex in each Fiducial Sphere. Tighten firmly.

**Figure 13: 5mm Ball End Hex Driver**



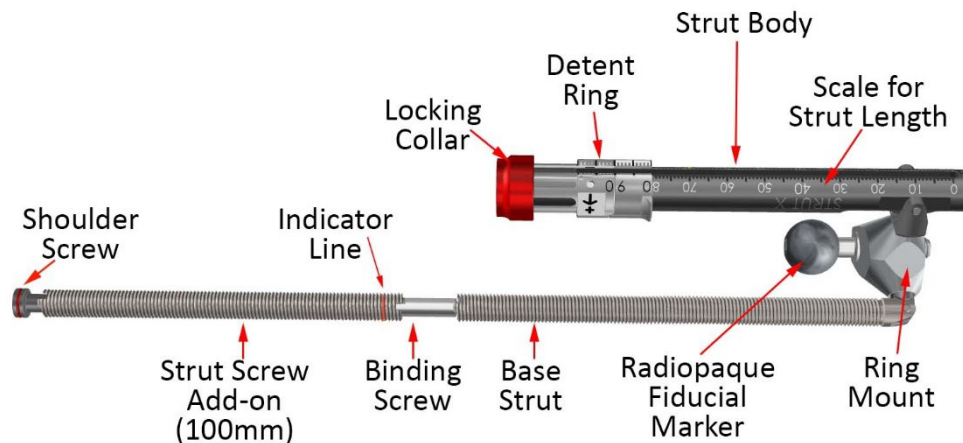
The 76-10012 5mm Ball End Hex Driver gives the Ring Mounts the final tool tightening by engaging the hex in each Fiducial Sphere.

**MANAGING THE SIXFIX STRUTS**

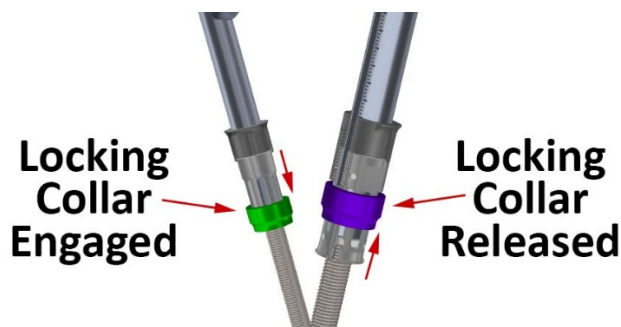
The SixFix Hexapod consists of six (6) Strut Assemblies that come pre-assembled.

1. Features of the SixFix Strut

**Figure 14: Identifying the Components of the Strut Assembly**



**Locking Collar** – the Locking Collar slides in the direction away from its Ring Mount to secure the strut screw, preventing it from sliding freely through the Strut Body. The color of the Locking Collar is the chromatic designation of the strut number and follows the colors of the spectrum:



**Colors and Numbers of Struts:**

RED	#1
ORANGE	#2
YELLOW	#3
GREEN	#4
BLUE	#5
VIOLET	#6

**Detent Ring** – When the Locking Collar is engaged, the Detent Ring is turned to change the strut length. Notice the directional arrow and the plus and minus signs. Turn the Detent Ring in the appropriate direction depending on whether you are lengthening the strut (+ Plus) or shortening the strut (- Minus).



Turn the Detent Ring in the direction of this arrow to lengthen the strut 1mm for each full turn.



Turn the Detent Ring in the direction of this arrow to shorten the strut 1mm for each full turn.

**Strut Body** – The Strut Body encases the strut screw mechanism and serves as the measuring gauge for strut length. The strut number is etched on each Strut Body as a precaution for color blindness.



Instructions for reading the length can be found on page 15 under the heading “Determining the Length of a Strut.”

**Ring Mount** – The Ring Mount provides the secure attachment of the Strut Assembly to the ring by threading the Fiducial Bolt into a threaded hole in the ring.

**Radiopaque Fiducial Marker** – The Radiopaque Fiducial Marker enables the SixFix DACS to create an accurate 3D representation of a 2D radiograph of a SixFix Hexapod. The Radiopaque Fiducial Markers also enable hand-tightening of the Ring Mount to the ring. The top of the Radiopaque Fiducial Marker has a hex that accepts the Hex Driver for final tightening of the Ring Mount.

**Base Strut** – The Base Strut provides the initial 200mm of length to the Strut.

**Binding Screw** – The Binding Screw, a component of the Strut Screw Add-on, joins the Strut Screw Add-on to the Base Strut.

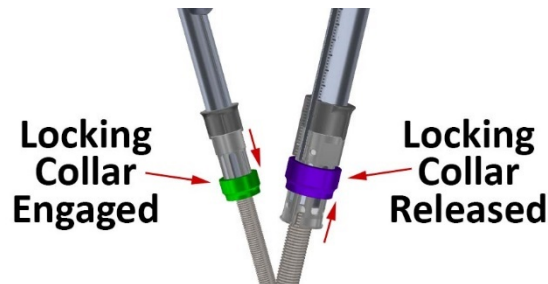
**Strut Screw Add-on** – The optional Strut Screw Add-on extends the length of the Strut from 200mm to 300mm without having to perform a strut exchange. The Indicator Line on the Strut Screw Add-on shows the strut length if the Shoulder Screw is outside the Strut Body.

**Shoulder Screw** – The Shoulder Screw provides the line that indicates the length of strut as measured by the scale on the Strut Body. It also serves to ensure that the Strut Screw is restrained from advancing beyond the Strut body and to seal the open end of the Strut Screw.

## 2. Engaging and Releasing the Locking Collar

When the locking collar is in the released position, the strut screw slides freely within the strut body. Engage the locking collar by sliding in the direction away from the strut body and toward the strut screw. This secures the strut at the desired length.

**Figure 15: Engaging and Releasing the Locking Collar**



The Locking Collar can be engaged by sliding it away from the Strut Body. Adjustments to the length of the strut is now achieved incrementally by turning the Detent Ring.

When the locking collar is secured, gradual adjustment is achieved by turning the Detent Ring in the direction of the minus sign for shortening or toward the plus sign for lengthening.

## 3. Rapid Adjustment of the SixFix Strut



The SixFix Strut can quickly be transformed into rapid adjustment mode when the Locking Collar is released by sliding it toward the Strut Body.

## 4. Fine Adjustment of the SixFix Strut



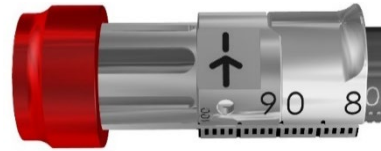
To incrementally adjust a SixFix Strut, the Locking Collar must first be engaged. Slide the Locking Collar away from the Strut Body.



The strut is now in the mode to lengthen or shorten by 1mm per complete rotation of the Detent Ring.



Turn the Detent Ring in the direction of this arrow to lengthen the strut 1mm for each full turn.



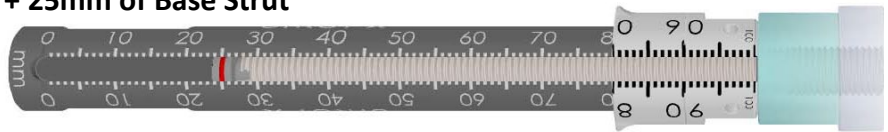
Turn the Detent Ring in the direction of this arrow to shorten the strut 1mm for each full turn.

### 5. Determining the Length of a Strut

The length of a strut is read from the location of the indicator line on the Shoulder Screw or on the Strut Screw Add-on by referring to the Strut Body measuring scale.

- Measuring from the Base Strut

$$125\text{mm} = 100\text{mm Strut Body} + 25\text{mm of Base Strut}$$



When measuring off the Base Strut, the strut length is read from the red reference line on the Shoulder Screw plus the minimum length of 100mm. In this example the strut length is **125mm**.

- Measuring from the Reference Line on the Add-on Strut

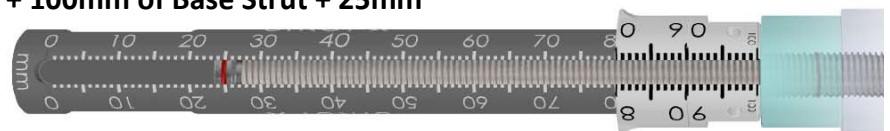
$$125\text{mm} = 100\text{mm Strut Body} + 25\text{mm of Base Strut}$$



If an Add-on Screw is engaged and the Shoulder Screw is not within the Strut Body, the measurement is read from the red reference line on the Add-on Strut. In this instance the strut length is still **125mm**.

- Measuring from the Reference Line using the Shoulder Screw on the Add-on Strut

$$225\text{mm} = 100\text{mm Strut Body} + 100\text{mm of Base Strut} + 25\text{mm}$$

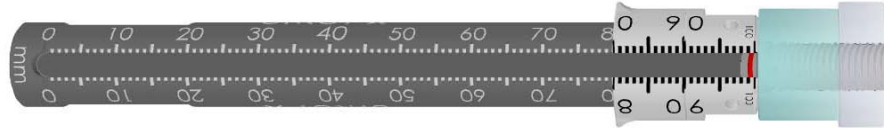


The length is again indicated by the red reference line on the Shoulder Screw when the Shoulder Screw enters the scale on the Strut Body. When this happens, add 200mm to the length as it is

indicated: 100mm for the minimum length of the Strut Body plus 100mm for the length of the Base Strut.

- The Maximum Length of the SixFix Hexapod Strut is 300mm

**300mm = 100mm Strut Body + 100mm of Base Strut + 100mm of Strut Add-On**

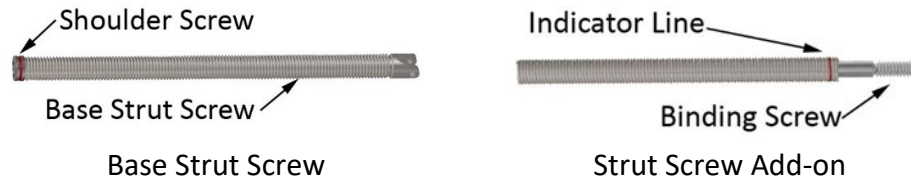


The maximum length of a SixFix Hexapod Strut is 300mm when one (1) Add-on Strut is fully extended: 100mm Strut Body + 100mm of Base Strut + 100mm of Strut Add-on.

#### 6. Attaching a Strut Screw Add-on

The Strut Screw Add-on is attached to the existing strut with the binding screw to enable the strut to attain an additional 100mm in length. The Strut Screw Add-on features an indicator line to show the length of the strut when the Shoulder Screw extends outside of the Strut Body.

**Figure 16: Base Strut Screw and Strut Screw Add-on**



**Figure 17: Exploded View of Strut Screw Add-on and Base Strut Screw**



The following steps outline the procedure for attaching the Strut Screw Add-on.

Step 1:

**Figure 18: Attaching the Strut Add-on [Step 1]**



Remove the Shoulder Screw from the existing strut assembly using the Modular Torque Limiting Handle and the 3/32" Hex Driver with an AO Quick Connect. Place the Hex Driver assembly into the open end of the Strut Screw Add-on until it engages the head of the binding screw.

Step 2:

As the binding screw is threaded into the base strut screw, the differential threads pull the Strut Add-on toward the existing base strut screw.

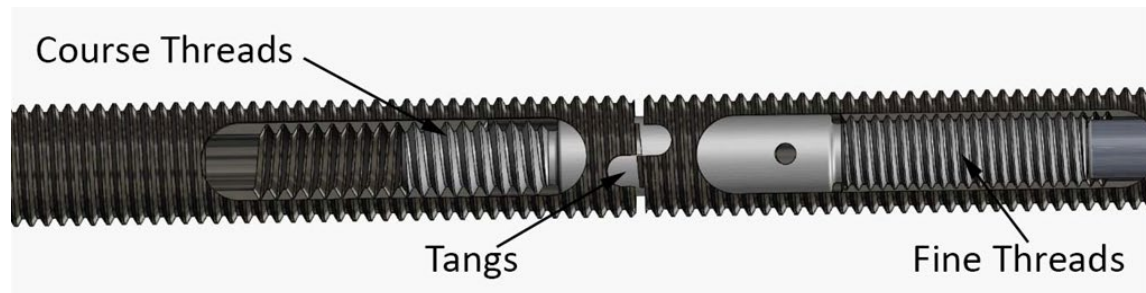
**Figure 19: Attaching the Strut Add-on [Step 2]**



Step 3:

The course threads pull the binding screw, advancing it into the existing base strut screw. When the tangs engage, the Strut Add-on stops turning and the fine threads begin engaging to pull the Strut Add-on to the existing base strut screw.

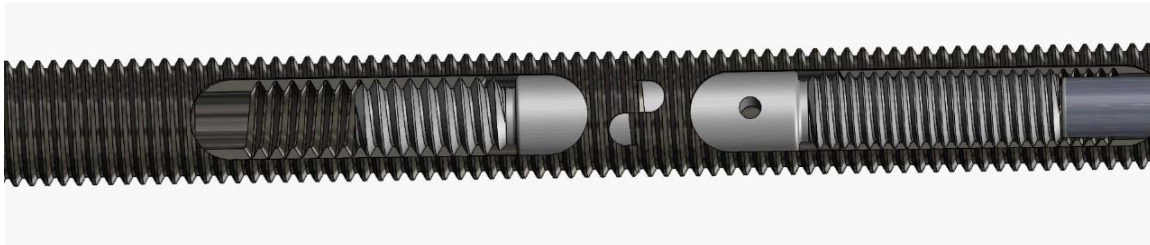
**Figure 20: Attaching the Strut Add-on [Step 3]**



Step 4:

The Binding Screw is advanced until the Torque Limiting Handle clicks to indicate that the screw is sufficiently tightened. The tightened Binding Screw holds the two struts in dynamic tension to ensure a stable construct.

**Figure 21: Attaching the Strut Add-on [Step 4]**



#### 7. Removing a Strut Screw Add-on

Removing a Strut Screw Add-on is very similar to adding a Strut Screw Add-on.

1. Remove the Shoulder Screw from the existing strut assembly.
2. Place the Modular Torque Limiting Handle and the 3/32" Hex Driver with an AO Quick Connect into the open end of the Strut Screw Add-on until it engages the head of the binding screw.
3. Turn counterclockwise to loosen and remove the Binding Screw and Strut Screw Add-on.
4. Remove the Strut Screw Add-on and replace the Shoulder Screw in the opening of the Base Strut Screw.

### STRUT CLIPS

Strut Clips are partial cylinders of either plastic or aluminum snapping between the Locking Collar and Detent Ring to secure the Locking Collar in the engaged position.

**Figure 22: Strut Clips**



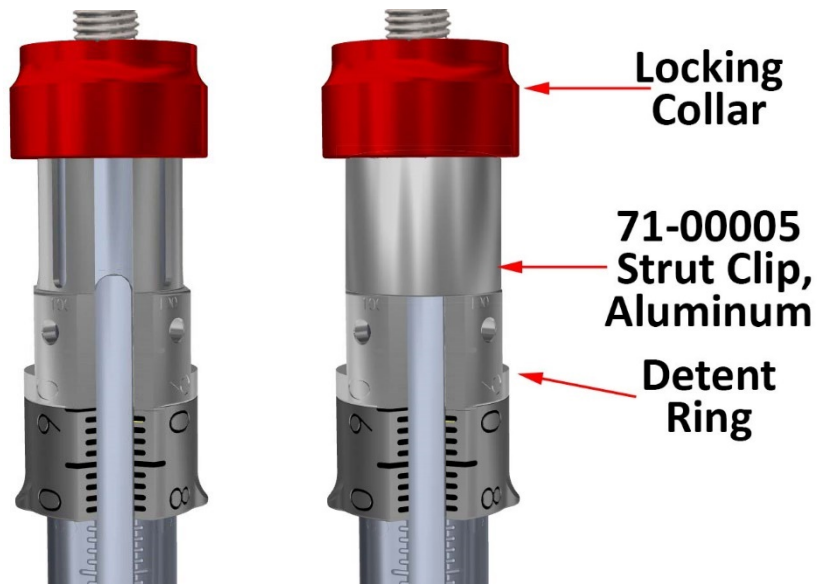
71-00004 Strut Clip, Plastic



71-00005 Strut Clip, Aluminum

The Strut Clip is snapped into the gap between the Locking Collar and the top of the Detent Ring. The Strut Clips prevent the Locking Ring from moving from the fully locked position by supporting the Locking Collar from underneath while the Strut Clip is resting on the Detent Ring.

**Figure 23: Strut Clip Inserted on Strut**



## POST-OPERATIVE MANAGEMENT OF THE SIXFIX

### 1. Gradual Deformity Correction

The correction of limb deformity is performed by gradual strut adjustment according to the prescription. Each full turn of the Detent Ring produces 1mm of strut lengthening or shortening.



Turn the Detent Ring in the direction of this arrow to lengthen the strut 1mm for each full turn.



Turn the Detent Ring in the direction of this arrow to shorten the strut 1mm for each full turn.

The adjustment can be monitored by a noticeable detent (click) every half turn (0.5mm). The measuring scale on the Strut Body should also be carefully monitored. The direction of strut length change (lengthening or shortening) depends on the type of deformity corrected.

The patient/caregiver must be instructed by the physician to:

- Make the adjustments or get help in making the adjustments as needed;
- Identify on the prescription when to return for follow-up visits or to have a Strut Add-on attached or removed;
- Report if the adjustment schedule cannot be met.

- Report any adverse or unexpected effects such as strut breakage or disengagement, component damage or lost prescription.

2. Attaching and Removing a Strut Screw Add-on

For attaching a Strut Screw Add-on, refer to 6. Attaching a Strut Screw Add-on page 16.

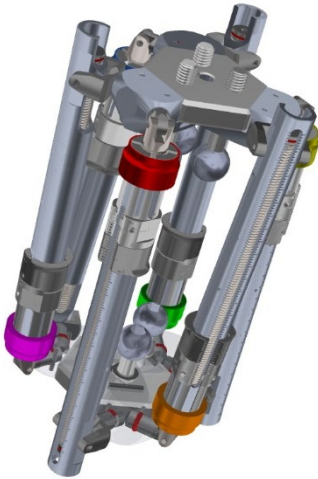



For removing a Strut Screw Add-on, refer to 7. Removing a Strut Screw Add-on on page 18.

**GENERAL PRINCIPLES OF SIXFIX DACS USAGE**

Please refer to the SixFix Deformity Analysis and Correction Software (DACS) User Manual for detailed instructions to take advantage of the benefits of the associated SixFix software.

**SIXFIX COMPONENTS**

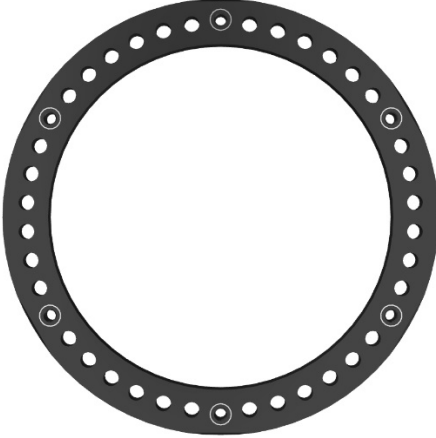
**SIXFIX STRUTS**

Item No.	Description	
71-00001	Strut Assembly	
71-00002	Strut Screw Add-on, 100mm	
71-00003	Strut Screw Add-on, 75mm	
25-0040	Shoulder Screw	
71-00004	Strut Clip, Plastic	
71-00005	Strut Clip, Aluminum	

**SIXFIX EXTERNAL SUPPORTS**


**FULL RINGS (ALUMINUM)**

Item No.	Description
71-10075	Full Ring, 75mm
71-10095	Full Ring, 95mm
71-10115	Full Ring, 115mm
71-10125	Full Ring, 125mm
71-10135	Full Ring, 135mm
71-10145	Full Ring, 145mm
71-10155	Full Ring, 155mm
71-10165	Full Ring, 165mm
71-10175	Full Ring, 175mm
71-10195	Full Ring, 195mm
71-10215	Full Ring, 215mm
71-10225	Full Ring, 225mm



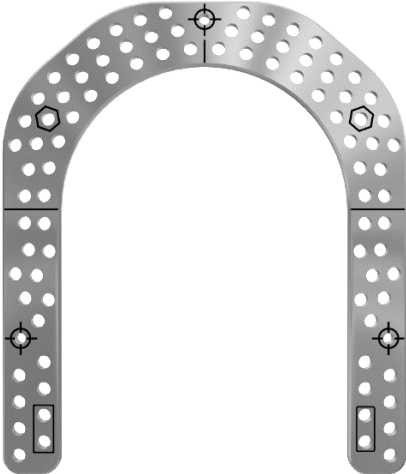
**2/3 RINGS (ALUMINUM)**

Item No.	Description
71-58095	2/3 Ring, 95mm
71-58115	2/3 Ring, 115mm
71-58125	2/3 Ring, 125mm
71-58135	2/3 Ring, 135mm
71-58145	2/3 Ring, 145mm
71-58155	2/3 Ring, 155mm
71-58165	2/3 Ring, 165mm
71-58175	2/3 Ring, 175mm
71-58195	2/3 Ring, 195mm
71-58215	2/3 Ring, 215mm
71-58225	2/3 Ring, 225mm



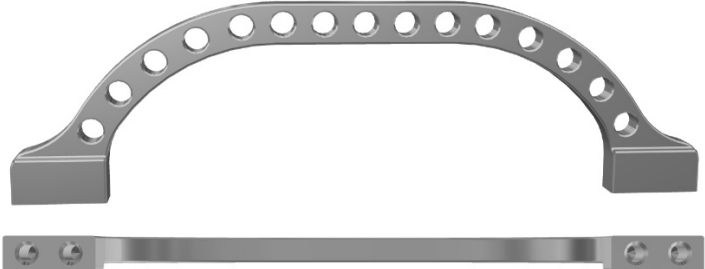
### FOOT RING (ALUMINUM)

Item No.	Description
71-6100L	Foot Ring, 150mm, Long
71-6100S	Foot Ring, 150mm, Short
71-6120L	Foot Ring, 180mm, Long
71-6120S	Foot Ring, 180mm, Short



### ARCH (ALUMINUM)

Item No.	Description
71-90150	Arch, 150mm
71-90180	Arch, 180mm



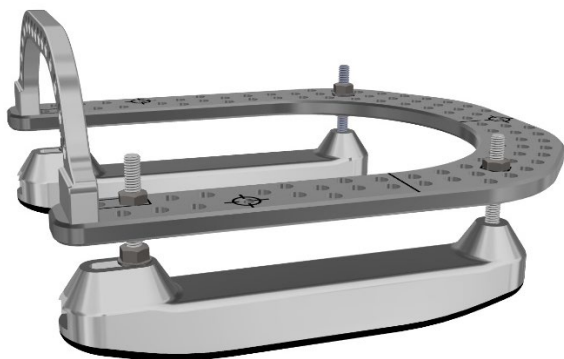
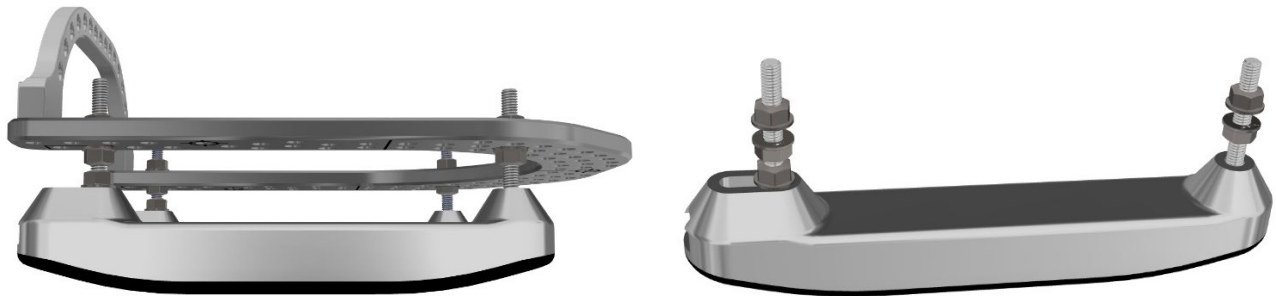
The arch is secured to one hole on each side of the foot ring with a 76-10162 Standard Hex Bolt 6 mm X 16 mm that enters the holes in the arch from underside of the foot ring.





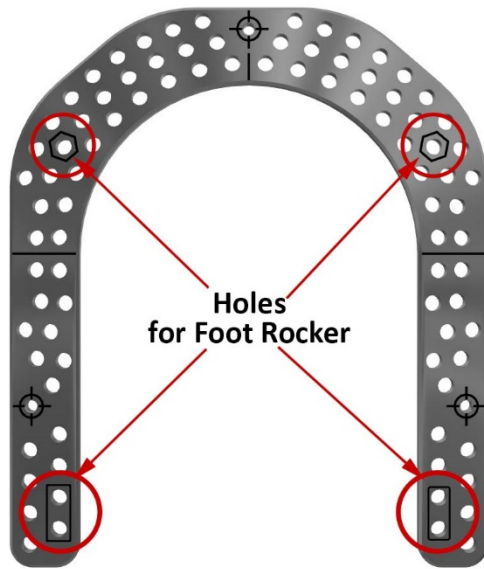
**FOOT ROCKER**

Item No.	Description
71-6130L	Foot Rocker, Long
71-6130S	Foot Rocker, Short

A 3D perspective rendering of the Foot Rocker assembly. It consists of a curved, semi-circular metal frame with a central horizontal bar. The frame has several adjustment points with screws. A flexible sole is attached to the bottom of the frame. The long version (71-6130L) is shown with a longer central bar, while the short version (71-6130S) has a shorter central bar.

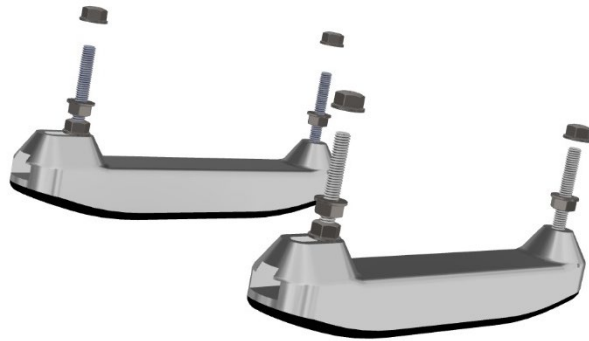
The SixFix Foot Rocker features a design allowing side-specific height adjustment to compensate for an angled distal foot ring. The anterior and posterior Rocker ends feature a 15° slope to help facilitate a natural gait. A flexible ABS sole helps improve traction during ambulation. The Foot Rocker comes in both short (71-6130S) and long (71-6130L) to fit the short and long Foot Rings. The Foot Rocker is for single-use only and is not designed to be clinically reprocessed.

### ATTACHING THE FOOT ROCKER TO A FOOT RING



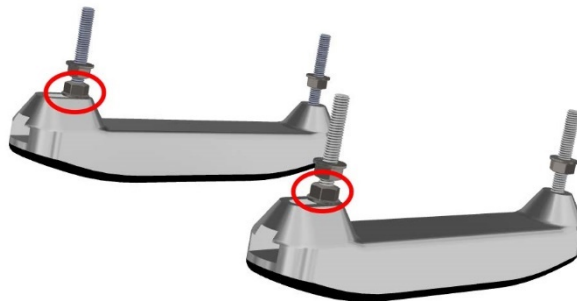
If Foot Rockers are indicated, do not utilize dedicated mounting holes for other frame components. Notice that the Foot Rocker occupies the holes with the hexagonal graphics in the back and either of the the two (2) anterior holes marked with a rectangle.

1. Remove the Outer Locking Nut



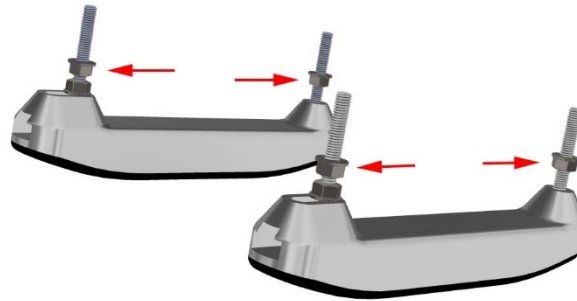
The Outer Locking Nut is a 10mm hex flange nut.

2. Decide which of the anterior Foot Rocker holes on the Foot Ring are to be used. These are the two (2) holes highlighted by a rectangle on both left and right side of the Foot Ring. The Foot Rocker will fit either of these two (2) alternatives. Slide the bolt through the hole and tighten the most distal nut.



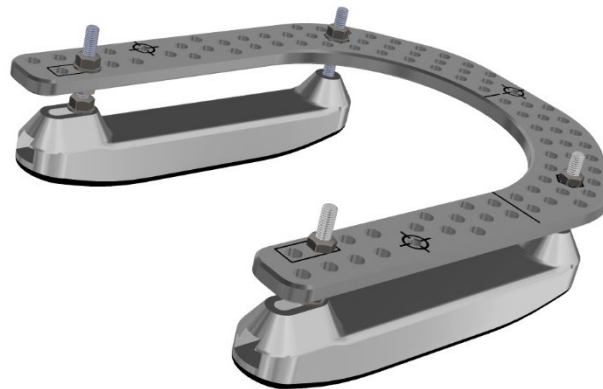
In this instance, notice that the posterior holes within the rectangle were selected.

3. Determine the best height for each Foot Rocker and adjust the height of the middle nuts accordingly.

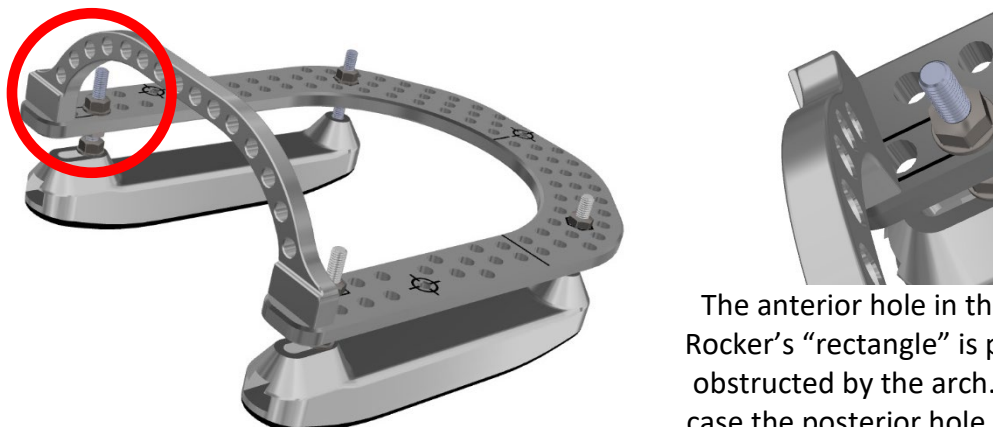


The height of the rails can be uneven relative to each other but they should keep the foot in the neutral position.

4. Place the Foot Rockers on the Foot Ring being certain the posterior bolts enter those holes in the Foot Ring marked with a hexagon and the anterior bolts in the holes marked with a rectangle. Tighten the bottom bolts anteriorly to secure the post to the Foot Rocker. Finally, tighten the bolts on the superior surface of the Foot ring.



Notice that the anterior posts are in the posterior hole in the rectangle. This is because the arch covers a portion of the anterior hole.



The anterior hole in the Foot Rocker's "rectangle" is partially obstructed by the arch. In this case the posterior hole is used.

## RING SELECTION

Select rings that allow for at least 2 cm of clearance (2 fingers' width) between the skin and the ring. Ensure to consider the thickest portion of the affected limb and any anticipated swelling of the limb. Plan to position the proximal ring on the affected limb at least 5 to 6 cm proximal to the fracture, orthogonal to the long axis of the bone. It is recommended for one of the six (6) circled ring holes be located directly anterior. Each of these holes is threaded to accept the Fiducial Bolt that secures the Ring Mount to the ring. Slide the ring above the knee to allow for insertion of the first wire.

## ATTACHING WIRES TO THE FRAME

**Select the properly sized wire.** Available wire sizes include 1.8mm and 2.0mm for both smooth wires and olive wires.

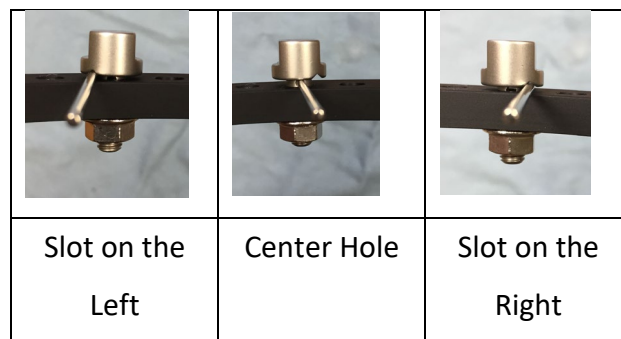
**Select the appropriate location** being aware of safe zones.

**Insert the wire.** Using power, insert the wire perpendicular to the long axis of the bone. Consider using the 4.0mm Pin Drill Sleeve (76-10040) to hold the wire near the bone while also protecting soft tissue.



**Advance the ring into a position along the wire to allow for maximum soft tissue clearance.** As the location of the initial connection for this first wire is assessed, be certain to rotate the ring such that a circled and threaded hole is aligned anteriorly. This hole will accommodate the Ring Mount with the small Fiducial Sphere.

**Connect the wire to the ring with Combination Bolts and tighten with nuts.** Place the wire between the head of the Combination Bolt and the ring. Wires can be placed either above or below the ring. The wire can pass through the hole in the center of the Combination Bolt or on either side of the bolt in the slot. With one



**Figure 24: Using the Combination Bolt**

10mm wrench stabilizing the head of the Combination Bolt, tighten the nut to secure the wire. The Combination Bolt opposite this bolt will be where tension is applied.

**Applying tension to the wire.** Move to the side of the ring opposite of the ring from the Combination Bolt just tightened. Completely open the handles of the wire tensioner to pass the wire through its cannulation. The tip of the wire tensioner engages the edge of the ring. Tension is then applied to the wire by squeezing the handles of the wire tensioner. The wire should be tensioned from 70kg to 110kg. Tension is assessed by reading where the force markings line up with the housing of the wire tensioner.

**Tighten Combination Bolt and nut.** Hold the wire tensioner in place, maintaining tension. The nut on the same side is tightened to the Combination Bolt. This will lock the wire under tension. Release the wire tensioner and remove.

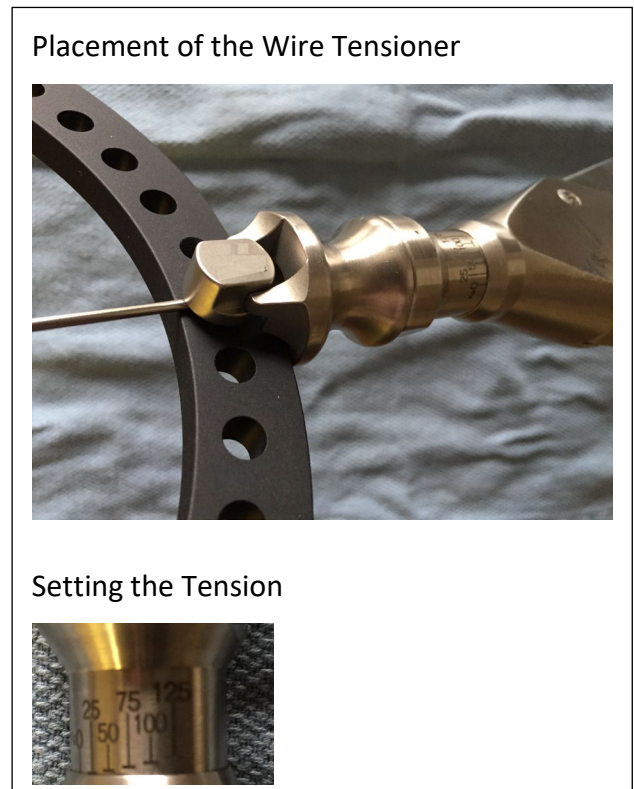
**Cut the ends of the wire.** After tensioning cut the ends of the wire. Leave at least 80mm (about 4 finger widths) of wire past the Combination Bolt in the event that additional tension needs to be applied to the wire. Curl the ends of the wires.

Prior to applying the second fixation element, manipulate the orientation of the ring until achieving the desired alignment.

#### **ATTACHING HALF-PINS TO THE FRAME**

Half pins may be placed as needed for additional fixation and stability. When placing half pins, alternatives to attach the pins to the frame include the following half-pin fixation devices: The Rancho Cube, Universal Half-Pin Fixation Bolt or the 15° or 30° Pin Cube.

**Use a nut to loosely attach the half-pin fixation device to the ring** in line with the desired location of the screw insertion.



**Figure 25: Wire Tensioner**

Insert the Pin Drill Sleeve and Trocar through the half-pin fixation device and finger tighten the nut.

Figure 26: Pin Fixation Device Summary

	Rancho Cube	Universal Half-Pin Fixation Bolt	15° and 30° Pin Block
Image			
Attaching to the Ring			
Centering Sleeve	Rancho cube. Centering Sleeve for 4mm and 5mm.	Not applicable	Not applicable
Securing the Half-pin	<p>Tighten M6 set screw with a 3mm hex driver to secure the half-pin. Tighten the Nut with a 10mm combination wrench to attach the Rancho Cube to the ring.</p>	<p>Tighten bolt with nut using 10mm combination wrench to attach to the ring.</p>	<p>Tighten M6 bolt with 10mm combination wrench to secure the half-pin in the pin block and another to attach the pin block to the ring.</p>

**Make an incision** down to bone, ensuring the incision is large enough to allow insertion of the pin drill sleeve assembly. Pre-drill for the desired size half-pin. Remove the pin drill sleeve assembly.

**Inserting the half-pin.** Attache the T-Handle (76-10009) to the appropriate size Pin Adaptor that corresponds to the half-pin to be inserted. The half-pin can also be advanced through the near cortex with power using the appropriate sized Pin Adaptor. Complete insertion is achieved manually with the T-Handle.

Perform final tightening of the device securing the half-pin within the half-pin fixation device.

**Figure 27: T-Handle and Pin Adaptors**

76-10009 Handle, T, AO QC



76-10044 Pin Adaptor QC AO 4mm (Blue)  
76-10054 Pin Adaptor QC AO 5mm (Yellow)  
76-10064 Pin Adaptor QC AO 6mm (Black)

