

# Posts and clamps

The four sections of the telescoping post are adjusted by releasing one or more of the red clamps at the top of each section.

Be sure to support all sled portions that will be freed before you release the clamp.



**Do not extend any section beyond the point where the yellow alignment line becomes red.**

Note: There is no safety line inside the posts to keep them from separating, but there are electrical wires inside the post that will keep the rig parts together. The longer the rig, the more these wires will act like a safety line, but don't rely on them.

**Do not twist the bottom section more than 180 degrees** from the top section as this will also twist the internal cables.

If you think you may have inadvertently twisted the internal cables, remove the camera and battery and make the rig as short as possible.

Release the clamp and slide the bottom section (the electronics) completely off.

Examine the curly cord. The two rubber tubes that support the wires should be parallel and not twist.

Rotate the bottom section until the rubber tubing is not twisted, and put the sled back together.

## Maintenance Tips:

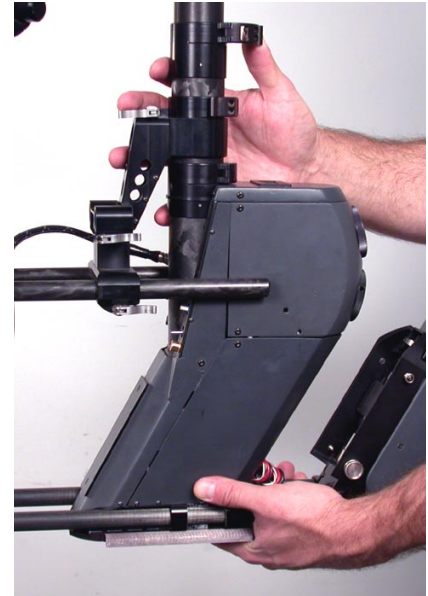
The Ultra uses several different tool-free clamps. Although they come pre-adjusted at the factory, they will have to be adjusted from time to time.

The key thing is to tighten the clamps a little at a time; a small change in a clamp's adjustment can produce enormous changes in the pressure on the parts. In general, the clamps should be just tight enough to work.



A 3/8ths open end wrench is needed to adjust the cams. Try an eighth turn or less to start, and test not only the strength of the clamp, but be sure it opens and closes easily.

The gimbal clamp, the monitor clamp, and the three main post clamps are tightened via a pair of set screws. These screws are adjusted with an Allen (hex) wrench.



Again, an eighth turn or less is a good starting point. Test that the clamp easily opens and closes, as well as holds both axially and radially.

Give the rig a good spin and a quick stop to be sure nothing shifts.

Be sure that both adjustment screws equally engage the striker plate. This can be done by feel.

Nonpermanent Loctite™ or red nail polish should be used to keep the set screws in place.

# Arm Adjustments

## Weight capacity

The Ultra arm has a total lifting capacity of 40 to 65 pounds.

The technique for adjusting the weight carrying capacity of the Ultra arm differs slightly from previous arms (from all models except the Master Series Steadicams).

No tools are required to adjust the arm strength, but the Steadicam must be worn to adjust the arm.

**Unlike other arms, the Ultra arm is isoelastic and does not seek one position. When it is adjusted properly, it will hold the sled over a wide range of the arm's travel.**

The section being adjusted must be held at a slightly upwards angle for the adjustment knob to turn.

**Very important: Adjust the forearm section first.** Make sure it properly carries the load.

Then adjust the section closest to the operator so that it follows or tracks with the forearm section as the operator booms fully up and down.

Getting the second section to follow the first can be a little tricky, so you may have to repeat this process several times.



Adjusting the upper arm section first. The arm must be angled up for the adjustment screw to turn.

# Arm Posts – High Mode

In general, use the shortest possible post in the arm. This avoids possible clearance problems below the arm.

To adjust the height of a post in the arm, squeeze the tabs on the retaining spring and slide the post to the desired position. To change an arm post, simply squeeze the tabs, pull out the post and replace with another, and release the spring.



**The quickest way to increase lens height is to use a longer post in the arm and to raise the socket block on the vest.** See the lens height charts on pages 36 and 37 for details.

This increase in gimbal height (and therefore lens height) - up to eleven and a half inches - puts the gimbal about as high as one can comfortably reach with the operating hand.

A longer arm post could be used, but one can't reach the gimbal and do the most precise work.

**Be aware that using a long arm post can exert enormous torque on the arm bearings and bones.**

**The heavier the camera is, the shorter the arm post should be.**

**If you want a very high or low lens height, get a light camera!!**

Remember, a long arm post alters the height of all the components equally, which may make viewing the monitor more difficult or annoying. Check to see what works; every situation is a little different.

The ability to quickly change arm posts or to adjust the height of the socket block on the vest, and/or to extend the sled components, gives the operator many choices to achieve a given range of lens heights and viewing options.



# Arm Posts – Low Mode

**In normal low mode, about eleven inches at the bottom of the arm's boom range is wasted. Wasted.**

This wasted boom range occurs because the operator's hand can't reach the gimbal without the operator bending over and therefore losing form and control.

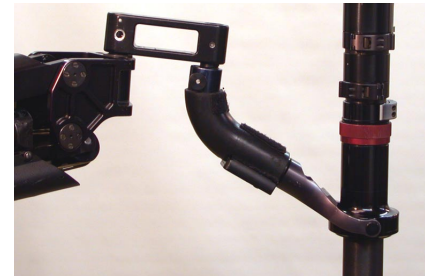
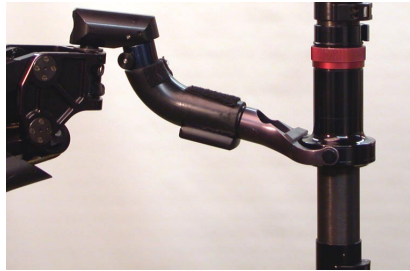
**The operator can regain some or all of that wasted boom range by using longer arm posts and by raising the socket block on the vest.**

Raising the socket block on the vest restores about three inches of the arm's range, without affecting anything else. Check out the lens height charts on page 37.

Use a longer arm post to further raise the F-bracket and the gimbal height. The length of the arm post is limited by the clearance requirements with the camera and film magazine.

When using a longer post in the arm, the F-bracket – and therefore the gimbal and the sled and the camera – is raised relative to the arm. The longer the arm post and the shorter the sled, the more likely the arm will hit the camera.

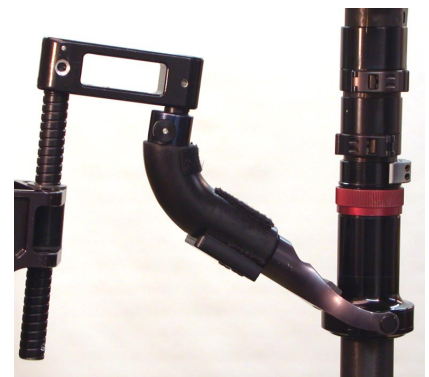
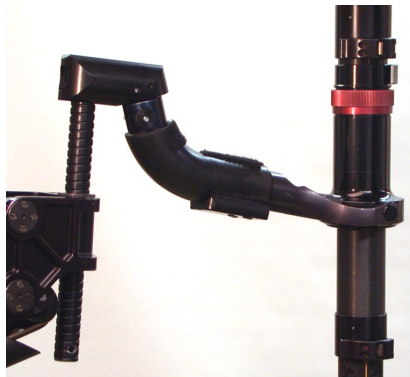
**When the sled's telescoping post system is expanded adequately,** the operator can use the twelve inch arm post to restore the full useful boom range of the arm without sacrificing the lowest lens height.



Here are some comparisons of gimbal height relative to the end of the arm.

The traditional F-bracket on the right (with the shortest possible post) drops the gimbal about three inches further than the new F-bracket (above).

At first glance, this might seem to be a good thing - getting the lens lower - but in fact the operator can't reach the gimbal when boomed all the way down on the arm. Also, the greater difference in height of the operator's two hands creates more stress.



A six inch arm post restores almost all of the arm's boom range.

The same six inch arm post and the old F-bracket.



With the twelve inch arm post we regain all of the lost boom range.

If the sled is too short, the arm will hit the camera.

# Arm Lift Angle

**Determining your threads is part of basic operating technique.** Two adjustment screws in the socket block on the vest and two "rod ends" in the mating section of the arm determine the angle of lift of the arm.

**These two adjustments are your "threads." They are personal and critical for good operating.** Some combination of adjustment of these screws – and your physique and posture – will make the arm lift straight up when carrying the sled.

The angles of adjustment are not directly "in-out" and "side-to-side," but rotated about 30 degrees clockwise (relative to the operator). We can suggest approximate threads to start, but the only way to test your threads is to pick up the Steadicam and see what happens.

**For almost all operators, regardless of body type, the typical adjustment for the "side-to-side" screws (the rod ends in the arm) is 1.5 to 2 turns out on the top screw and ALWAYS all the way in on the bottom screw.**

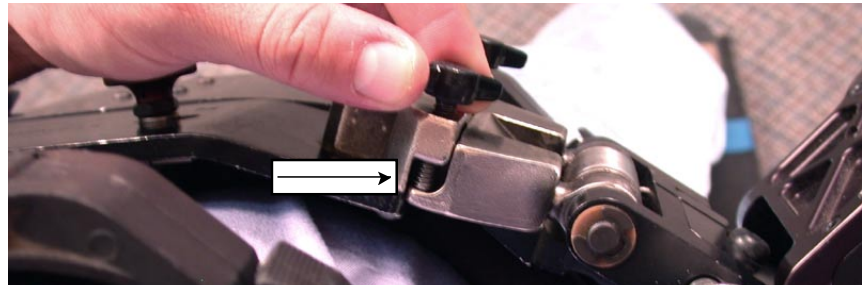
Use the rollers when the arm is not under load. Use a 1/4 inch Allen wrench when carrying the sled. **The two side-to-side screws work independently of one another. Do not tighten the lower screw, but be sure it is all the way in, and then back it out 1/8th of a turn.**



*Use a 1/4" allen to adjust the "side-to-side" screws. When wearing the rig, be sure to hold the centerpost in line with the "in-out" thumbscrews. This will take the loading off the side-to-side screws. See page 8 for adjusting side to side screws with newer titanium arm socket.*

**The "in-out" adjustment on the socket block varies greatly by the operator's body type.**

If you have big pecs and a flat stomach, the top screw is almost all the way in. If you've been eating well and exercising less, the top screw will be further out.



*Looking down at the top "in-and-out" screw. Count the threads indicated by the arrow. This is a typical adjustment for a person in reasonable shape.*

Always dial in the top screw first to your setting, then turn in the bottom screw until it just snugs up against the fitting. **There is no need to tighten the bottom screw very hard.**

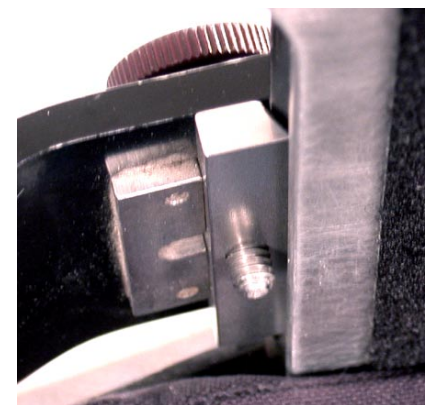
With both pairs of screws properly adjusted, the camera will float in all positions with the operator standing relatively comfortably.

**If you want to operate "goofy-foot," – with the sled on the right side – you will need to reverse the socket block.**

On the vest, loosen the socket block height adjustment screw. You may have to tap the plate hard with your fist to get everything to release. Flip the plate and retighten the clamp. **Be sure the dovetail clamp is inside a small retaining rail - see photo below right.**

On the arm, pull the "parachute pin," flip the mating block, and reinsert the parachute pin.

Note that the mating block is now reversed; the upper side-to-side adjusting screw is now the lower screw and vice versa. **To set your threads, first dial the lower screw all the way in, then adjust the upper screw to your threads - about 1.5 to 2 turns out. Use the same procedure to change back to left side operating.**



# CRT and LCD Monitor Adjustments

On the far left is a three position switch to turn the monitor on, warm up in standby, or off.

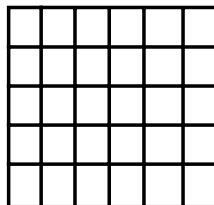


It's a good idea to put the monitor in "standby" for ten to twenty seconds before switching it fully on, especially when the monitor is not warmed up.

Unless you have several minutes between takes, it's good to leave the monitor in the standby mode.

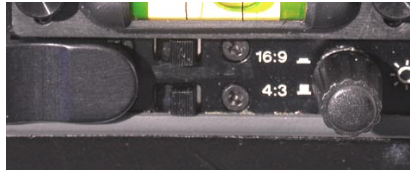
Hot and humid conditions also call for leaving the monitor in the standby mode, but keep the monitor out of the sun and as cool as possible.

**Tip:** When shooting film – with or without anamorphic lenses – it's helpful to have a black and white chart of squares or circles available for properly setting the vertical gain. Otherwise, your image may be a bit squeezed or stretched.



Under the sliding cover are two switches to flip the image right to left and upside down.

Slide the cover to the left when the monitor is in the off or standby position. You may find this feature useful from time to time, for instance with a very long sled in low mode.



The three pots on the right side control the image. The first pot is a "push-pull" switch. In the "in" position, the image on the monitor is fixed to the video standard 4:3 size and turning the pot has no effect.

Pull the knob out, and two things happen. First, the image widens to fill the screen horizontally. Second, the pot now controls vertical gain.

Use this pot to rescale the vertical size with the expanded horizontal size or to correct an anamorphic image.



To set the brightness and contrast, use the middle and right side pots. In general, you will get a good image if you turn both pots all the way down (counterclockwise) first.

Next, turn up the brightness pot (the middle one) until the monitor begins to glow. Then turn up the contrast pot to get the image you want. Fine tune the image with the brightness pot.



These are the controls for the 8.4 inch LCD color monitor. The big knob on the right is for brightness.

All the other controls are accessed via an onscreen menu.

The five buttons on the left are used to navigate the menu.

Pushing the green "M" button gets you to the menu, and the "Down/Up" and the "-/+ " button pairs move you around the menu.

You can also set various user parameters, such as vertical size or how long the menu display remains on the screen after your last entry.

One interesting feature: You can assign the D/U and +/- button pairs to a particular function, say "zoom" or "freeze frame." Pushing one of those buttons *before* you push the "M" button will take you directly to the assigned function.

A full description of the menu options comes with the monitor.

# The Artificial Horizon

## How to set the electronic artificial horizon (the level indicator):

You must be sending a video signal via one of two inputs on the camera mounting assembly to see the display on the screen.



Set the function selector on the electronics module to the 11 o'clock position and turn the adjustment knob clockwise until the display appears. As you turn the knob, the display will go from black to grey to white to a glowing white.

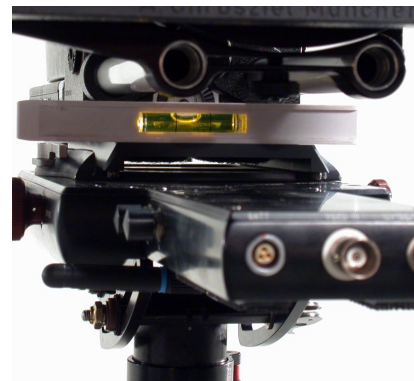
If the display doesn't appear, turn the function selector to the 7 o'clock position and rotate the adjustment knob in either direction until the display appears. (Note that the battery level indicator is also controlled by these settings.)



On the control panel is a small switch and a tiny pot to adjust the electronic bubble. This switch reverses the direction of the display; the pot centers the electronic level.



Set the switch so that the display moves the way you like it. Tilt the Steadicam from side to side and watch the display.



Place a simple bubble level on the camera or dovetail and make the camera level side to side. Adjust the pot until both horizontal lines of the display are on the bottom.

When you turn the sled over for low-mode shooting, flip the switch and go through the entire level adjustment procedure again.

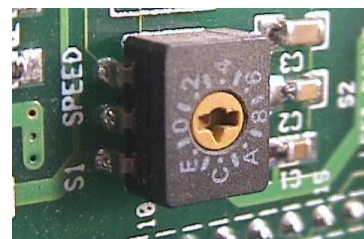
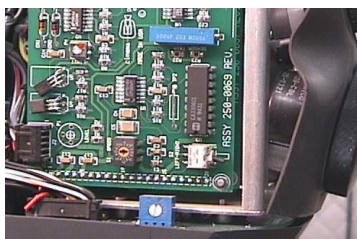
### Tip:

Many operators check their level indicator several times a day, to be sure everything is properly adjusted.

### Big Tip:

#### There is a hidden adjustment for the artificial horizon:

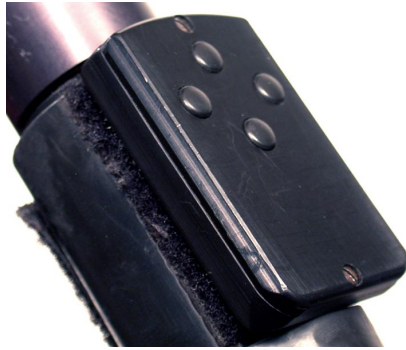
On the left side, under the cover of the electronics, is a special rotary switch that controls the response of an electronic damper.



Some operators like the display to move very quickly; others want to slow it down a bit to make the display more watchable.

Zero is the lowest setting. The damping increases from 1 through 9 and then A through F. "A" is a typical setting.

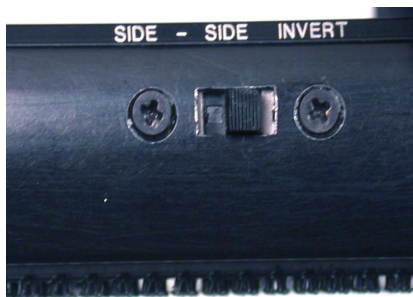
# Stage motor control



The motorized stage is activated by a special transmitter on the gimbal handle. The four micro switches control turn the motors on and off.

The receiver is housed in the forward compartment of the stage.

On the right side are two pots. Each pot controls the speed of one motor (the fore and aft motor or the side to side motor).



A switch on the left side reverses the direction of the side to side motor - useful when you flip the sled into low mode (and the motor direction is reversed from high mode).

The transmitter easily can be removed from the gimbal handle. It's held in place by a Velcro™ strip.

You might give the transmitter to an assistant to adjust the balance of the Steadicam for you as you go through a shot.

He or she can count revolutions of the stage motor knobs and/or move the sled to prearranged marks.



This is an actor's or a crew member's view of the Steadicam operator adjusting the precise balance of the sled using the stage motor transmitter.

## Why the stage motor system is so important for precise operating:

Before operators had the Ultra's reliable and precise stage motor system, trimming the Steadicam had to be done before the shot, and the Steadicam's balance was fixed.

As Garret Brown has often said, it was a situation akin to that of an airplane pilot landing his plane to adjust the flaps.

For precise work, so much depends on the Steadicam's balance.

With the motorized stage, that balance can be instantly altered to suit the shot's changing requirements.

## Some situations where the Ultra's motorized stage really helps:

Anytime the shot has radically different tilts that need to be held for a few moments.

In long mode (and sometimes in standard low mode), it is often difficult or impossible for the operator to reach the stage to manually adjust the sled's balance.

While shooting from a vehicle, it can be dangerous let the sled go with one hand to adjust the sled's balance.

In addition, it is far easier to push a button to tweak the Steadicam's balance than it is to reach up, twist a knob, and wait for the Steadicam to settle to a new attitude.

The easier it is to tweak the sled's balance, the more likely it is that the operator actually will take the time to precisely balance the sled.

# Dynamic Balancing



*A Steadicam sled is in dynamic balance when the center post remains vertical as the sled is panned.*

**Dynamic balance is extremely important for precise operating and also for whip pans.**

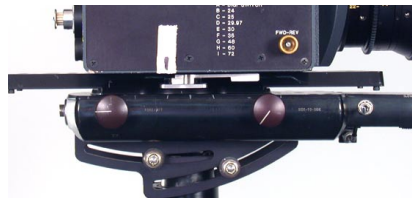
For each arrangement of camera, monitor position, post length, accessories, etc., there are many possibilities for statically balancing the Steadicam.

However, for each arrangement of camera, monitor position, post length, accessories, etc., **there is only one combination that also balances the sled dynamically.**

There is some leeway as to the required precision of dynamic balance. What is acceptable depends upon the operator and the situation.

Dynamic balance can be achieved by the trial and error method or by using the Dynamic Balance Computer.

In all cases, when a sled is in dynamic balance, both the camera's c.g. and the battery's c.g. will be to the rear of the center line of the center post.



This rule gives you some point to begin balancing the Steadicam.

First, set up your sled at the proper length for the shot.



Place the monitor where you want it, both for viewing and for its inertial effect, then **position the camera so that its c.g. is about .75 inches (19mm) behind the center post.**

The center post is 1.580 inches in diameter, so you can use the back of the post as a guide.



**Static balance with the battery so the sled hangs perfectly vertical fore and aft.**



**Trim side to side with the camera, using the knobs on the stage.** You can also use the stage motor remote control, as shown. Fine tune fore and aft balance with the motors as well.

Give the sled several careful test spins and note the results.

Good or bad; flat pan or wobbly?



Is it your technique or is the sled out of dynamic balance?

If the sled is out of dynamic balance, move *the battery* in or out a bit.

There are only two directions to choose from: you have a 50% chance of getting it right.

Be sure to make a note of which direction you move the battery.

Rebalance statically *with the camera* (racking it in the opposite direction), and spin the sled again. Better or worse? Again, you have two choices.

Re-rack, rebalance, and spin again (and again!) until the sled pans flat. This should not take a lot of time.

When the battery is within about 1/4th inch of ideal, the sled will behave nicely and feel "sweet."

**Adding any accessory will affect both static and dynamic balance.**

How much? It depends on the mass and position of the object, and the masses and positions of everything else on the sled.

You will discover that as the monitor is placed higher towards the camera, the closer the battery c.g. gets to the center post, and the more the camera c.g. moves away from the post to the rear. See the diagrams.

With any given monitor position, the heavier the camera, the closer its c.g. will be to the center post.



**Tip:**

The monitor tilts and pivots on its center of gravity, so changing the angle of the monitor will not affect dynamic balance.

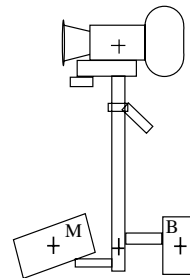
The tilting head nearly preserves the camera's center of gravity, so tilting the camera also has very little effect on dynamic balance.

To get a better idea of the effects of various changes, play with the dynamic balance computer (see the next two pages).

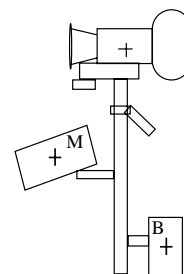


**Three figures to study for understanding dynamic balance.**

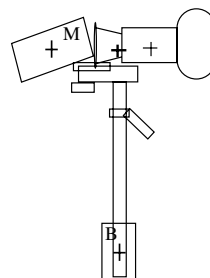
The top figure looks like the Model One or the SK. The camera c.g. is centered over the post; the monitor and battery are on the same horizontal plane, and their common c.g. is in the post. This unit is in dynamic balance and pans flat.



The second figure has the monitor raised a bit. This looks like most Steadicam configurations, high or low mode. Note that the battery c.g. is closer to the post, and the camera c.g. has moved to the rear. Why?? See the third figure.



In the third figure, the monitor has been raised all the way up in front of the camera. It's absurd, of course, but it makes a point.



Now the common monitor and camera c.g. is over the post, and the battery's c.g. is directly under the post.

So you can see that as the monitor is raised, the camera c.g. must move to the rear and the battery c.g. must move towards the post.

With the Ultra (and most Steadicams), the monitor is always raised above the battery. Therefore camera is always to the rear of the centerpost.

# The Dynamic Balance Computer

With so many possible configurations with the Ultra, spin balancing for dynamic balance could be time consuming and unproductive.

However, the dynamic balance computer makes finding and maintaining dynamic balance easy.

## A few measurements are required prior to using the computer.

You need to know the weight and position of the accessories you carry on the sled, such as your focus motor receiver and amp, VCR, etc.

## Use an accurate scale to weigh all your accessories.

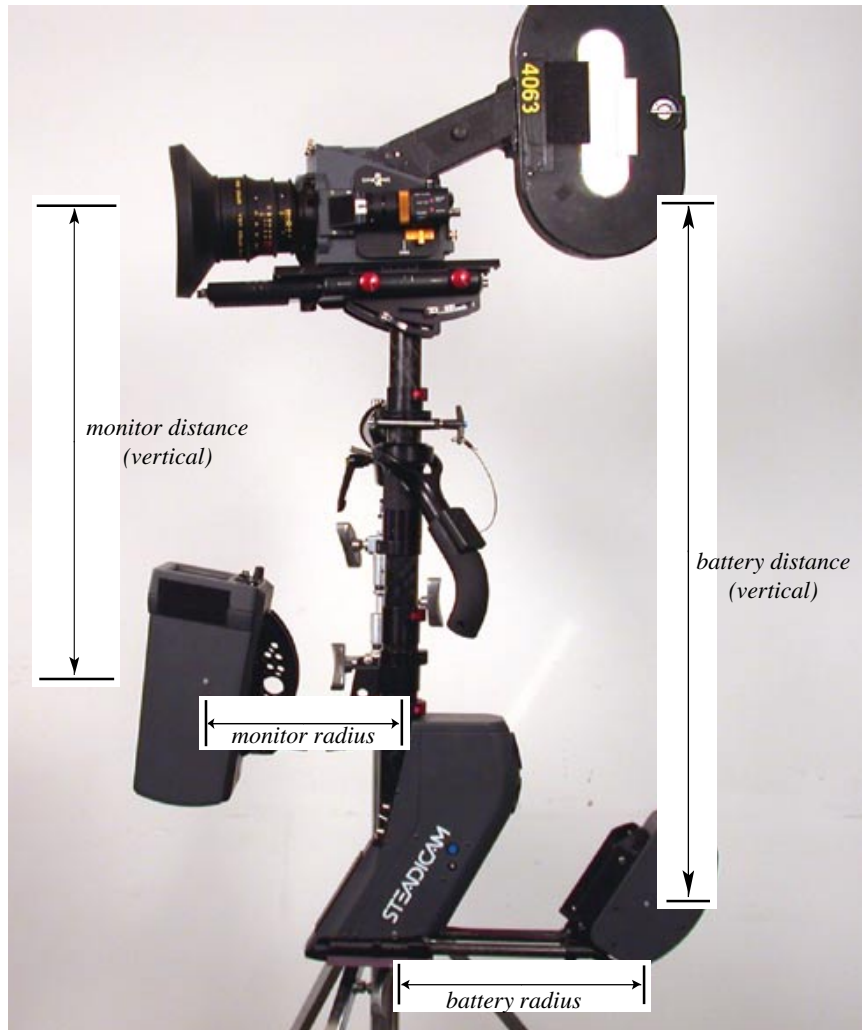
Measure both the vertical distance from each accessory's c.g. to the camera's c.g., and the radius (or horizontal distance) from each accessory's c.g. to the center line of the telescoping post.



## Motors and other accessories you carry on the camera - and the camera's weight - can be ignored.

Enter the information about the accessories in the appropriate data fields to set up your basic package. Multiple setups can be stored in memory to simplify this process.

Whenever you change the height or extension of the monitor, or the length of the sled, (to best configure the Steadicam for the shot), you take one to three measurements and enter them into the appropriate data fields.



## The three measurements for each new configuration are:

- 1): the vertical distance from the camera c.g. to the battery c.g.;
- 2): the vertical distance from the camera c.g. to the monitor c.g.;
- 3): the horizontal distance from the monitor c.g. to the centerline of the telescoping post.

Enter these new values into the data fields, and the computer determines the exact battery radius.

You complete the process by static balancing the rig with the camera.



### Some tips on using the computer:

Plastic "dots" on the monitor and battery indicate the c.g. of these components. The camera c.g. can be determined by a simple balancing test.

If you remove an accessory, just enter a zero in the radius or weight field.

Vertical measurements are not that critical! Change the monitor or battery distance field by an inch or two or three and see what happens in the computed (battery radius) field.

The program also computes the camera position if you happen to know the exact weight of the camera, lens, mag, film mattebox, filters, etc.

*However, it is not necessary to know the weight of the camera and its accessories to use the dynamic balance computer.*

Once you properly position the battery, all you need to do is static balance the sled by moving the camera, and your sled will be in dynamic balance.

As you adjust the sled's length, you don't need to measure distances or enter new data for accessories that "hang" on post #4 along with the battery and electronics. The computer automatically recalculates these values for you.



### Conversion Tips:

1 ounce = .0625 pounds.  
1 kilogram = 2.204 pounds



The more accurate the measurements, the better the dynamic balance computer will work.

Play with the computer to discover how various changes to the sled affect dynamic balance.

Enter an approximate weight for the camera. Change the weight and see what happens to the computed battery and camera positions.

What is the camera position for the weight of camera you are carrying when you change the sled length and/or monitor extensions? Add a transmitter to the camera magazine?

### Weight chart for some accessories

**pounds**

Preston large motor	.94
Preston small motor	.72
Heden motor with idler gear & mounting bracket	.62
FMG-6 motor	.72
Staton motor with hardware	.44
Preston MDR-1 receiver/amp	1.50
Preston MDR-2 receiver/amp	1.34
Bartech receiver/amp	.75
Genio receiver/amp	.89
Seitz receiver and amp with cables	1.25
Modulus 3000 transmitter with antenna	.44
Coherent CVT-500P transmitter	.30

Getting the basic information into the computer is probably the hardest part of using the computer.

Getting accurate weight measurements for all the bits and accessories that fly with the sled can be challenging. Try going to the grocery store late at night and use a digital meat scale.

You can also use the manufacturer's published weights or the chart above.

Be sure you have the right weights entered in the data fields for the type of batteries you are carrying, and for your monitor or spare monitor. The computer may be programed for a different battery or monitor.

# Inertial control

All Steadicam sleds work (in part) because various masses are added to and mounted away from the camera, which slows down the camera's angular response to external forces.

Our primary tool for inertial control is extending or compressing the centerpost and/or the battery, monitor, and other components.

The "moment of inertia" generated by each component is a function of its mass (weight) times *the square* of its distance to the center of rotation (the gimbal). Doubling the distance creates four times the inertia.

Positioning masses away from the gimbal will increase inertia, while bringing them closer to the gimbal (the point of rotation) will reduce inertia. In general, the "bigger" the sled is, the slower its rotation and the more stable it will feel.

Extending the center post will slow down the rig's angular response in tilt and roll, while extending the battery and/or monitor will slow down the rig's response in tilt and pan.

Reducing the length of the post or bringing in the battery and monitor will make the rig rotate more quickly on those same axes.

If you want a quick, fast panning and tilting rig, bring the masses in as close as possible to the gimbal. If you want a slow rig, or need the shot to be as stable as possible, spread the masses far apart.

Every time you move one component, other things happen with static and dynamic balance and with viewing and clearances and stability.

**To get one effect or benefit you may have to sacrifice performance in some other area.**

For instance, changing the post length also will have some effect on the lens height (although a lot less than the post extension), and the position of the gimbal relative to the camera mounting stage or the electronics module. Experiment to become familiar with all that happens as you move components around.

**Always remember to make the Steadicam's balance and inertia work for you, not against you.**

Although the sled is stabilized in all three axes, the sled is most stable or inert in the tilt axis.

This is the consequence of an important, early design consideration, which was to get the Steadicam close to the body and to make panning the Steadicam as easy as possible.

*Ultra at minimum horizontal extension. Monitor radius, 6 inches; Battery radius 5.5 inches. About 415 pound in<sup>2</sup> of inertia in pan. Note the cute trick with the monitor bracket that makes this possible.*



*Ultra at maximum horizontal extension. Monitor radius: 12 inches. Battery radius: 13 inches. About 1,870 pound in<sup>2</sup> of inertia in pan.*



*Note that neither the battery nor the monitor rods are fully extended in this photo.*

# The Tilt Head

The integral, low profile head is designed to alter the lens angle plus or minus 20 degrees from horizontal with no more than a minor shift of the camera's c.g. relative to the post.

**The most important use of the tilt head is in normal operating.**

**Instead of trimming for a shot by altering the Steadicam's balance, use the tilt head to preserve a vertical post and keep your sled in dynamic balance.**

Without the tilt head, much of the benefit of getting the sled into dynamic balance is wasted when one alters the trim of the rig as much as a few degrees.

For example, operators routinely trim their sleds for headroom.

This action puts the rig out of both static and dynamic balance.

With the Ultra, the operator determines the proper length of sled, optimal monitor viewing position, inertia, and lens height. Then the operator adjusts the camera to the nominal tilt angle for the shot.



The operator sets the tilt by releasing the two clamps and manually repositioning the camera to the proper angle.

The post remains vertical and the rig stays in (or close to) dynamic balance.

Only minor static rebalancing is normally required, but exactly how much depends on the camera, accessories, sled length, monitor position, etc.

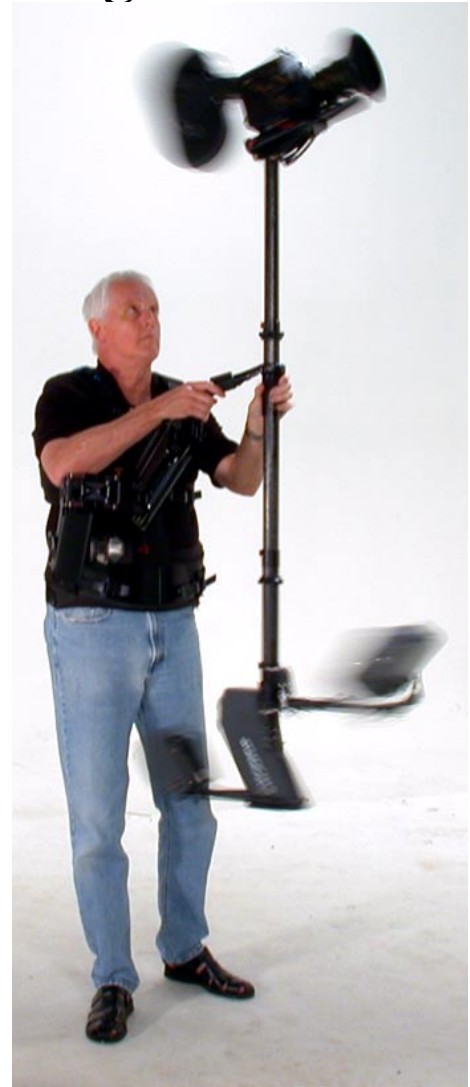
In all cases, bringing the sled back into static balance by moving the camera fore or aft will make the sled very close to being in dynamic balance.

# The Tilt Head – General Operating



Even if the Steadicam is slightly out of perfect dynamic balance, **it's a whole lot easier to hold the post vertical than at any other angle**, especially when panning and accelerating - which we tend to do a lot when operating a Steadicam.

The tilt head keeps the post vertical in many situations, making it easier to operate and keep things level.



**Another benefit of the tilt head: a whole new class of whip pans is now possible.**

All whip pans are done in dynamic balance with the post vertical. Previously this meant that the lens was always horizontal.

With the tilt head, the lens can be angled up or down as much as twenty degrees and the operator can still make extremely precise fast pans.

Using the tilt head will increase the precision of any pan with a lens angled up or down – fast or slow.

Long mode pans with the lens looking down - say at a crowd - used to be exceedingly difficult or impossible, due to the large spatial translations of the battery, monitor, and camera.

But the tilt head leaves the post vertical and therefore eliminates this spatial translation, and makes these pans routine. Low mode and very low mode pans are also much easier and more precise.

