STEADICAM®

CLIPPER 324™
CLIPPER 312™

Operating Manual

p/n LIT-257000

Clipper 324/312

Clipper™ , Clipper 324™ , Clipper 312™

Operating Manual

The Tiffen Company, LLC
90 Oser Avenue
Hauppauge, New York 11788
631 273-2500
800 645-2522
631 273-2557 fax

www.steadicam.com

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This manual is primarily written to inform experienced Steadicam operators about specific features of the Clipper 324 and 312 systems. While there is some basic information in this manual to get a novice started, we strongly urge anyone with limited Steadicam experience to take one of our three or six day workshops. For more information on professional workshops worldwide, contact The Tiffen Company at www.tiffen.com.

Overview

The Tiffen Company takes great pride in producing the Steadicam™

CLIPPER 312™ and
CLIPPER 324™

We are committed to excellence, innovation and service, and the Clipper is a system that will evolve with you. Each component of the Clipper is carefully designed so the operator can easily configure the Steadicam to the best possible advantage for each shot.

Tool free — Our guarantee that all the advanced features can be used under real-world, fast-paced conditions.

Modular design — We designed the Clippers to be easily modified, upgraded, maintained, and serviced.

The optional, position-sensing, super strong, motorized stage increases the precision and repeatability of every shot. Stage positioning is smooth and effortless, and operators can trim the sled's balance while shooting. "Go-to" buttons on the remote rebalance the sled to pre-determined positions — and return "home" — with just one touch.

The integral tilt head tilts +/– 15° to preserve dynamic balance, to maintain high or low lens height, to help with clearance, reach, or viewing problems, or to execute precise whip pans with the lens angled up or down.

The new, Wide Dovetail Lock has a broader, more positive grip on the dovetail plate. The handle has a safety stop to prevent accidental release.

The Clipper's gimbal is the smoothest, most precise gimbal ever made, with heavy duty, high precision bearings and an ergonomic yoke, and it's easy to take apart for cleaning. It comes with its own tool – The Blue Whale -– which operators use to precisely center the gimbal in the field, even after years of hard knocks.

Three section, carbon fiber telescoping post extends the sled from 26 to 49 inches (66-125cm) — or anywhere in between — for short to long mode shooting. The post, monitor, and gimbal clamps are either open and free, or positively locked with the clamp levers ergonomically recessed into the clamp bodies.

The swept-back monitor mount is designed for maximum stiffness, inertial control and viewing options. It has a wider range of positions, both vertically and horizontally, and the flip-to-low-mode dovetail mount is both quick and positive.

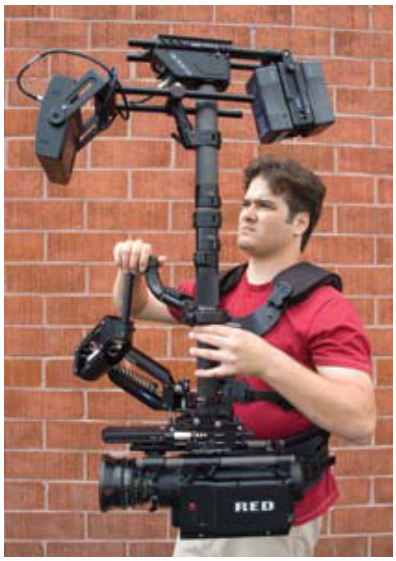
Modular Electronics — A "backplane" system replaces the traditional wiring harness and supports user-replaceable circuit boards. Microprocessors are software upgradable. Quick access to the most commonly used functions — framelines, level, brightness, and contrast.

Optional UltraBrite 2™ monitor — 8.4 inch, 1400 nits, advanced AR coating, and HDSDI, HD component, and analog composite direct inputs. Its unique design lets it run cool without a fan. On the front is an LED artificial horizon display, and two tally lights.

Structural Dovetail Base — solidly mount gyros, antlers, and other accessories. Includes positive latches for the battery rods and a pull out mounting plate for accessories.

Steadicam PowerCube™ dual battery pack (Clipper 324) provides 220 watt hours and high amperage discharge — plenty of power for the sled and today's power hungry 35mm and High Def video cameras. The Clipper 312 is a 12 volt system that uses either a single PowerCube or an Anton Bauer® battery. The new tilting battery mount creates more options for balancing and inertial control.

The innovative ***stiffening system*** creates extra rigidity whenever violent moves, a rough ride, or a very long post configuration requires some help.



The LX vest is lightweight and ergonomic, working perfectly with the new generation of G-series arms.

The G–50 arm is amazing, lifting from 12 to 50 pounds (5.4 to 22.7kg). The patented "Geo" feature, which changes the spring tension as you boom up and down, makes the G-50 the smoothest arm ever, with an astounding boom range of 32 inches (81.3cm). The "Ride" adjustment precisely tunes the arm's iso-elastic response. The arm posts are interchangeable with a rotational drag control.

All the features are integral to the design; ready to be used when you need them.

The Clipper 324 and 312 continue our tradition of building the world's most versatile and user-friendly Steadicams.

Note: If you are wondering what happened to post #1, it's only available in the Ultra[2]. Because of the number of options over the years of several models of Ultras and Clippers which share these posts, it's best to keep the post names consistent...

The Clipper Sled

Post #2 - Uppermost and thinnest post. 1.58 inch (40.13mm) diameter. Connects the tilt head and carries the gimbal.

Post #3 - middle post. Extends rig and carries the upper monitor mount.

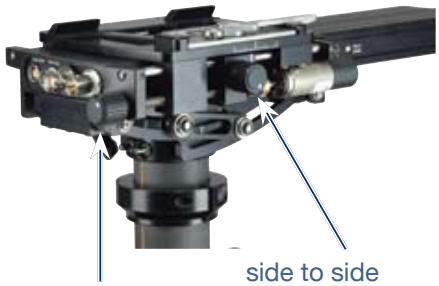
Post #4 - Carries the lower monitor mount, the base and electronics, battery rods, and lower dovetail.

The only difference between the Clipper 324 and 312 sleds is the battery system. The 324 uses two PowerCube™ batteries and a down converter for 12 volts, while the 312 is a 12 volt system, utilizing either one or two batteries. (Note: voltage ouput levels are dependant on battery types used. Please see specifications at end of manual for details.) All other mechanical and electrical components and options are identical.

Stage mechanics and adjustments

The dovetail clamp lever has three positions: forward and locked, 90° for adjustments, and 60° back for mounting or removing the dovetail plate. A safety button must be pushed to move the lever to the unlocked position; the same button holds the lever fully open, making flips to low mode and back a bit easier. Do not force the lever backwards beyond its stop.

The stage is easy to adjust. The knob at the right rear controls fore and aft, and the two knobs on the side control side to side movement.



fore and aft adjustment knob

side to side adjustment knob

Note: The Clipper can be ordered without a motorized stage, or with a single motor, or with two motors. Upgrading to one or two motors is a simple “plug-and-play” operation.

The stage connectors

At the rear of the stage, left to right (port side to starboard side):

- Camera power connector. 3 pin Lemo, +28V, +14V, and ground.
- Video out/12V Power. 4 pin Hirose
- HDSDI video in. BNC
- Composite video in to video distribution base at base of sled. BNC

Under the stage where the post meets the tilt head:

- Two SMB connectors for two of the three RGB lines

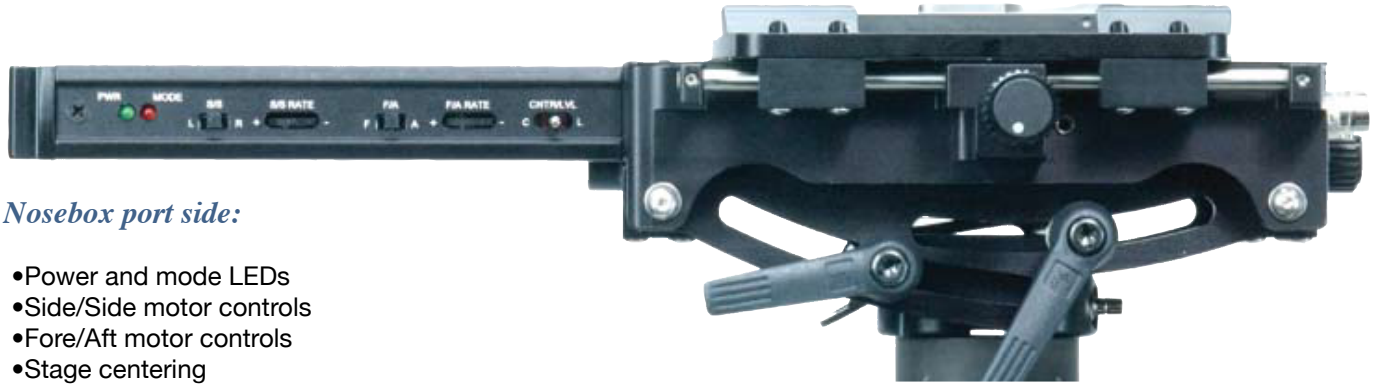
At the front (nosebox), left to right:

- Power for focus motor receiver/ amplifiers. 3 pin Lemo (+28V, +14V, and ground)
- Tally light connector (additional functions possible)

Nosebox starboard side:

- Pot to adjust Tally sensor sensitivity
- Rotary switch to set remote channel (0-8)

Clipper non-motorized stage



Nosebox port side:

- Power and mode LEDs
- Side/Side motor controls
- Fore/Aft motor controls
- Stage centering

The Clipper's optional motorized stage is position sensing – much like a focus motor system for a lens. One use of this feature is to set the stage to the center of travel, both fore and aft and side to side – great for initial setups.

Pushing the double pole momentary switch on the "nosebox" to the "C" side centers the stage.

Flipping the switch the other way ("L") sets the stage to a pre-programmed position (more about that later.)

The speed and direction of the motors is set by the switches and thumbwheel pots on the left (port) side of the nosebox (S/S & F/A). Note that the motor direction switches also have a center-off position, just in case you are in an odd RF environment or you don't want your stage motors to move. Remember this "function" when a stage motor stops working between takes!

The electronics in the stage and nosebox are on "plug and play" circuit boards, easy to replace if there's ever a problem. It's also easy to access to the inside of the stage — to clean, add or swap motors, adjust the bearings, take apart for servicing, etc.

Clipper non-motorized stage

The Tilt Head

The integral, low profile head is designed to alter the lens angle +/-15º from horizontal with only a minor shift of the camera's c.g.

The most important use of the tilt head is in normal operating. Instead of trimming even two or three degrees for a shot by altering the Clipper 324's balance, use the tilt head to preserve a perfectly vertical post and keep your sled in dynamic balance.

Trim for headroom

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. For example, operators routinely trim their sleds for headroom. This action puts the rig out of both static and dynamic balance.

With the Clipper 324, 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.

Setting the tilt

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

Note: Don't grab the stage by the nosebox to adjust tilt. Be sure to loosen the arc clamps fully and grab the camera or dovetail plate. Don't force anything; it should move fairly easily.

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 will return the sled to dynamic balance as well (see page 44).

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.

Smart Motorized Stage

The motorized stage is important for precise operating

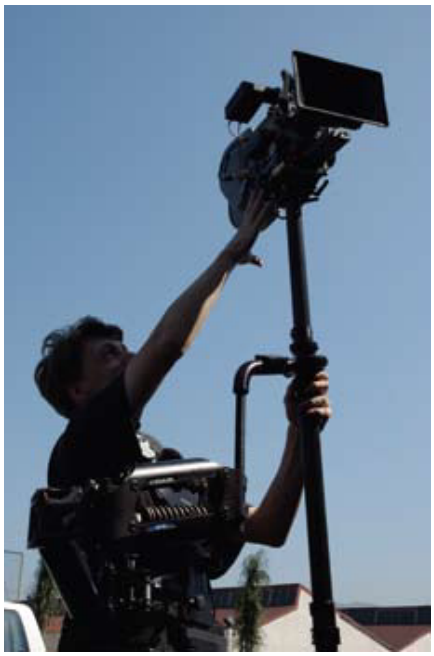
This is a crew member's view of the Steadicam operator adjusting the precise balance of the sled using the wireless transmitter — a 3 second exposure! Really!!

For precise work, the Steadicam must be carefully balanced or trimmed.

Before operators had a motorized stage, all balancing had to be done before the shot and therefore the Steadicam's balance was fixed throughout the shot. As well as that works, it was, as Garret Brown has often said, a situation akin to that of an airplane pilot landing his plane to adjust the flaps.

With the Clipper's motorized stage, the operator can continuously adjust the sled's balance during the shot — assuring the utmost precision for every moment.

When you push a button to change the Steadicam's balance, you maintain your posture, stance, and grip, so even conventional, pre-shot balancing is quicker and more accurate.



Some situations where the motorized stage really helps:

• Anytime you want to trim precisely and quickly, whether trimming on the fly, in the middle of a shot, or holding an opening frame perfectly still.

• 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 awkward or even dangerous to balance the Clipper without the remote control.

"Go-to" Buttons and the Smart Motorized Stage

On the remote control, there are three "go-to" buttons on one side in addition to the four original "trim" buttons (as well as two other "spare" buttons).

The go-to buttons move the stage to specific marks, defined by the operator. One position is usually the nominal balance, and the other two are programmed for some other part of the shot. During the shot, the operator (or an assistant holding the removable remote) pushes and quickly releases a go-to button to move the stage precisely to a new trim setting. Pushing the "home" button at any time returns the stage to the nominal trim. No more counting revolutions or so many seconds; the stage moves exactly where you want it to — and back.

In addition to big tilts and Dutch angles, you might set a button to "post perfectly vertical and in dynamic balance," and use another button for the nominal trim for the shot at hand. Or set the three buttons to roughly account for the side to side movement of film in some magazines.

Programming is a snap; it's just like programming stations on a car radio. Move the stage to the desired position, either manually or using the traditional trim buttons. Then hold one of the go-to buttons down for three seconds. The green LED will flash twice, and it's set. You can even program any button on the fly, during the shot, if you have the mental reserves...

Each go-to button simultaneously programs the fore and aft and the side to side position of the stage. Trimming fore and aft may slightly alter your side to side balance, or you may want to program in a severe Dutch angle. You can even program two or three buttons for the same trim if you like, so you don't have to think about which button to push!

The positions are stored in non-volatile memory, so changing batteries or turning off the sled power does not erase your presets.

The center go-to button on remote shares the same preset as the "L" position on the switch on the nose box. The "L" position is programmed exactly like the center go-to button on the remote, and the red mode LED on the nosebox will flash to confirm programming.

The "C" button can be programmed the same way as the "L" button. It might be useful to reprogram the "center" position if you were working with a camera and the nominal balance was shifted significantly side to side. Then every time you changed lenses or started the day you would not have far to go to rebalance side to side.

Holding one of the go-to buttons down for more than six seconds will clear all programming for that button and make it non-operational. The green LED will flash 3 times. It's a good idea to clear out all 3 buttons at the beginning of the day.

Ergonomics

regular

The remote control is ergonomically designed, and it rotates to any angle for your comfort, whether you operate normally or goofy-footed.

goofy

Low mode: Typically, the remote is upside down in low mode. With the Clipper you can orient the remote for better low mode operation.

To angle the remote, loosen the small set screw in the curved handle of the gimbal.

Orient the remote by screwing the curved handle in or out. If the handle is too far in, you can't easily remove the remote via the black knurled ring, and you might have to back the handle off one full turn. Loosening the setscrew a lot further and unscrewing the handle is also how you access the "tilt" bearings and shaft for cleaning.

For goofy foot operators, the remote can be inserted upside down keeping the go-to buttons on the "thumb side." You might, however, prefer accessing the go-to buttons with your index finger: i.e., orient the remote as you wish.

Removing the remote

Whenever you want to hand the remote off to your assistant (or charge the remote's battery), unscrew the knurled ring.

The remote is held in place by two sets of pins. The forward set of pins slips into two small holes, and the rear set of pins are captured in a groove in the knurled ring.

When returning the remote to the handle, insert the pins carefully and do not force anything.

If you want, you can remove the pins and just Velcro® the remote to the handle. A "half moon" filler plate is supplied with gimbal so that if the remote is removed, the filler can take its place.

Charging the remote

If the transmitter's battery is low, the LED will blink continuously after any button is depressed. To charge the remote, remove it from the gimbal handle. Plug the supplied cable into the remote and the other end into either one of the 4-pin HRS connectors on the sled.

Leave the sled on as you charge the battery. It takes about 5 hours to charge a completely discharged remote battery. When the battery is charging, the green LED will be on. When the lithium-ion battery is fully charged, the green light goes off.

If plugging in a fully charged transmitter, the LED will remain lit for approximately ten minutes until the charge circuit determines the battery is actually full.

Battery life can vary depending on how often the transmitter is used and the storage and operating conditions.

Changing the frequency

To avoid interference with other systems, 1 of 8 channels can be selected via the rotary switch on starboard side of nose box.

The remote and the receiver must be on the same channel. Simultaneously holding down the top 2 go-to buttons for 6 seconds will enter the remote into a channel change mode. The number of LED blinks will correspond to channel selected.

Change channels by pressing the fore or aft remote buttons (channel up or down). After the proper channel is selected, the programming mode will time out after 9 seconds and re-flash the selected channel number. Channel 0 corresponds to 8 flashes.

(For operation outside of the USA) To select between US and UK frequency operation, there are two jumpers that must be changed. One jumper is inside the nosebox, the other is inside the remote. They must match for the system to work. The jumpers are set at the factory at the time of shipping. (902 – 928MHz US and 868 to 870MHz UK)

The green "PWR" LED on nose box comes on when the CPU is operational.

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.

Posts and clamps

The three sections of the telescoping post are adjusted by releasing the 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.

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.

Locking the post clamps

The Clipper's post clamps are positive locking. They are either fully open or closed, and they snap shut with a healthy, positive click.

Do not force the lever further open than shown, as this can damage the mechanism

It's always good practice to give the rig a whip pan and hard stop to be sure nothing shifts.

If something shifts, the clamps are easily tightened with a small Allen wrench (3/32"). Adjust the screws with the lever closed — and go slowly — 1/8th of a turn or less at a time. Tighten both screws equally, so the clamp remains parallel to the housing. If the screws are over-tightened, the lever may not open or close. Test the clamp strength and lever action frequently as you adjust the tension.

Monitor mounts

There are two monitor mounts on the Clipper, one on post four (the bottom post) and one on post three. The two mounts are identical, and permit a large vertical range of monitor positions. The second monitor mount can be used for securely mounting a gyro, recorder, second monitor, etc.

Inserting the monitor mount

Align the parts parallel and squarely to each other. Note that the bracket is inserted half-way to start, rather than from above and trying to slide down the whole way from the top. The safety pin automatically retracts as you align the parts, and clicks to lock when the parts are aligned. Tighten the Kipp® handle hard to secure the monitor bracket.

Accessory shelf

Tucked inside the base of the sled is an accessory shelf for mounting extra monitors and recording devices.

The shelf is adjusted by removing four screws.

Maintenance

The Clipper uses several different tool free clamps. Although they all 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.

Use a 3/8ths inch open end wrench to tighten or loosen the lock nut for the monitor rods clamp.
Tighten or loosen in 1/8th of a turn or smaller increments, testing often both for the clamp's holding strength and for the action of the lever.

The gimbal

The Clipper shares the same gimbal as its bigger cousin, the Ultra$^{2™}$. The gimbal has been completely redesigned with higher-precision, high load bearings. The gimbal body, yoke, and handle are strong and precisely registered to each other. The yoke's new shape and contoured edges extends the range of motion without interference and promotes a better operating grip over a wider range of positions.

Note: You might notice that there is a small amount of in and out "play" between the handle that holds the remote and the Y shaped yoke. This is part of the gimbal design and is normal. In use, the play disappears.

Centering the gimbal

Note: This procedure is not necessary with a new rig from the factory.

The operator can easily center the gimbal in the field – useful if you've taken apart the gimbal for cleaning, taken a really bad bump, etc.

• Place the gimbal on the docking stud (as you would for normal balancing), give yourself a four second drop time, and aim the camera along a line through the two bearings in the yoke, as shown in the photo above.

• Balance side to side and fore-aft as precisely as you can to get the post vertical. We recommend you use a bubble level on the stage, and be sure that the tilt head is set 90˚ to the post (horizontal).

• Rotate the sled 90˚ so that the camera is aimed at along the axis of the yoke handle, as shown in the photo below. Tweak the fore-aft balance as precisely as you can, then do not touch the stage adjustments for the rest of the procedure.

• Rotate the sled 90° again, as shown below, and test for level. Rotate 180°and test for level.

• If the sled is level, great. STOP and DO NOT ADJUST ANYTHING.

Tip: We urge you to test your gimbal's centering with a normal drop time, and then with progressively longer drop times. Go slowly and follow the procedure closely, rebalancing carefully and testing everything as you go. Before you adjust anything, be sure it's not your balancing technique that is causing the problem, or a dangling cable, anything loose on the sled, or the wind. With long drop times, the sled is very sensitive to these shifts and influences.

Gimbal Centering

• Continue only if the sled is not level in both directions. Use the optional blue whale tool to loosen one of the two end caps 1/16 of a turn or so, and tighten the other one to the same degree.

Blue Whale Tool

• Turning the end caps moves the inner gimbal ring relative to the yoke, centering the gimbal.

• If the sled does not hang perfectly level, move the whole sled “uphill” with the two end caps.

• If it gets worse, you chose the wrong one to loosen! If it gets better, keep going until it is perfect. Do not rebalance fore and aft with the stage.

Adust the end caps equally – i.e. loosen one and tighten the other the same amount — and do it in small increments.

A small warning: do not over-tighten the caps against the bearings, as this will cause binding. Just tighten each cap down to touch the bearing. If the bearing starts to bind, just back off one of the two end caps until the gimbal is free again. The blue whale tool also makes it easy to take apart and clean the gimbal if this ever becomes necessary.

The base connectors

- Top: Monitor connector: 12 and 24 volt power, composite video, and data transmit and receive lines. 8 pin Lemo.
- Left: RCA video in/out for a video recorder. A small slide switch on the back sets in or out (see below).
- Center: HDSDI, direct connection to HDSDI connector in stage; no connection to the video distribution amplifier. If your electronics fail, you can use this connector to send a composite video signal to the monitor. BNC.
- Right: Video out and +14 VDC. 4 pin HRS.
- Bottom: Auxiliary 28 and 14 volt, 3 pin Lemo, good for powering gyros or other accessories.
- Lower front (between the rods): two SMB connectors for the red and blue lines for HD component video. Direct connection to the two SMB connectors under the stage.

Note: If you are not using the HDSDI and/or the HD component lines, you may use them for other purposes, such as a microphone line down the post or speaker wires up the post.

Clipper 324/312 Switch Matrix

On top of the Clipper's base is a multi-position switch that determines what standard definition video signal appears on the monitor and at the three video output connectors. It has no effect on High-definition signals.

There are two possible sources for the video signal: the camera (via the BNC on the stage), and a signal fed into the RCA jack on the front panel of the sled base. The latter is only available if the "In-Out" switch is set to "In."

There are four video outputs: the monitor, the two Hirose connectors, and the RCA jack when set to "Out."

You can add framelines to the camera's video signal to each output.

It is not possible to add framelines to a video signal coming into the RCA jack.

The RCA jack, when set to "In," sends video only to the monitor. The two Hirose connectors always are fed a signal from the camera.

The default setting (#8) adds framelines to camera's video signal going to the monitor, but not to the RCA connector, nor to the two Hirose connectors.

Settings 0 though 7: Framelines are not added to the camera's video signal that is sent to the monitor. You have various choices and combinations of adding framelines or not to the other outputs.

Settings 8 though F: Framelines are added to the camera's video signal that is sent to the monitor. You have various choices and combinations of adding framelines or not to the other outputs.

Example: You want framelines added to the monitor and to the RCA output (i.e., to a recorder), but not to either Hirose connector. Use setting #9.

Connector	**0**
**** Mon (Front Panel)***	
Camera Video Input	X
Camera Video Input with FLG Overlay	
RCA Video Input	
† Mon (Front Panel)	
Camera Video Input	
Camera Video Input with FLG Overlay	
RCA Video Input	X
**** RCA (Front Panel)***	
Camera Video Input	X
Camera Video Input with FLG Overlay	
Hirose (Front panel)	
Camera Video Input	X
Camera Video Input with FLG Overlay	
Hirose (Stage)	
Camera Video Input	X
Camera Video Input with FLG Overlay	

NOTE:
**** = RCA switch set to "OUT" position.***
† = RCA switch set to "IN" position.
Position #8 is the default position.

The 12 and 24 volt low battery warning levels are set at the factory. If you want to alter the settings, there are two pots, marked 12T and 24T for this purpose.

To adjust each pot: Set the sled for 12 or for 24 volt operation. Hook the sled up to a variable power supply, dial in the voltage that you want as the warning point, and adjust the pot until "low battery" is indicated: LED's flash next to the on-off switch and the on-screen indicator blinks.

An alternative method: power the sled from a battery. Wait until the low voltage indicator on the battery starts to show low, then adjust the pot until the sled shows a low voltage. Or you can calibrate using the battery voltage indicator on some cameras.

Selector Switch Position Clipper 312/324 (257-0003 PCB) 02-25-08

1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
X	X	X	X	X	X	X								
							X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	X		X		X		X		X		X		X	
X		X		X		X		X		X		X		X
X	X	X					X	X	X	X				
			X	X	X	X					X	X	X	X
X			X	X			X	X			X	X		
	X	X			X	X			X	X			X	X

How to set up your frameline generator

The four buttons on the frameline generator control the framelines, crosshairs, on-screen horizon position, and battery indicator position, as well as the frameline style, crosshair style, graphic brightness, graphic elements on or off, and two stored frameline and graphic presets.

	Frameline Mode Descriptions	MODE ENTRY REQUIREMENTS				KEY FUNCTIONS WHILE IN MODE			
#	MODE	UP	DOWN	LEFT	RIGHT	UP	DOWN	LEFT	RIGHT
1	Recall Frameline Position #1	>2 sec.							
2	Store Frameline Position #1	>4 sec.							
3	Recall Frameline Position #2				>2 sec.				
4	Store Frameline Position #2				>4 sec.				
5	FLG On/Off			>1 sec.					
6	Graphics On/Off		>1 sec.						
7	Cross Hair position			>1 sec.	>1 sec.	Move UP	Move DOWN	Move LEFT	Move RIGHT
8	Horizon position			>2 sec.	>2 sec.	Move UP	Move DOWN	Move LEFT	Move RIGHT
9	Battery position			>3 sec.	>3 sec.	Move UP	Move DOWN	Move LEFT	Move RIGHT
10	Graphics Brightness	>1 sec.		>1 sec.				DECREASE all	INCREASE all
12	Lower & Left Frameline position		>1 sec.	>1 sec.		Move UP	Move DOWN	Move LEFT	Move RIGHT
13	Upper & Right Frameline position	>1 sec.			>1 sec.	Move UP	Move DOWN	Move LEFT	Move RIGHT
14	Frameline style select		>1 sec.		>1 sec.	Style #1	Style #2	Style #3	Style #4
15	Cross Hair style select		>2 sec.		>2 sec.	Style #1	Style #2	Style #3	Style #4
16	EXIT	X	X						
17	Factory Reset	X	X						

The charts tell you how it all works — here's one example. Suppose you want to move the position of the horizon display. You enter the horizon position mode by simultaneously pushing down the left and right buttons for about two seconds. The horizon graphic will pulse on and off. You move the graphic UP, DOWN, LEFT, or RIGHT by pushing the appropriate button.

If no buttons are pressed for several seconds, the FLG will exit the horizon position mode. You could also press the up and down buttons simultaneously to exit the programming mode.

You can store the current settings for the framelines, crosshair, horizon, and battery by holding down the UP button for about four seconds. "SET #1" will be displayed on the screen for one second.

If you change something and want to return to these settings, just push the UP button for about 2 seconds — "PRESET #1" will be displayed on screen for one second. Note the little "1" symbol by the upper button.

The second preset is controlled by the RIGHT button — it's also marked "2."

	Frameline Mode Descriptions	IN-MODE INDICATION DISPLAYED ON SCREEN	MODE EXIT REQUIREMENTS	COMMENTS
#	MODE	"*" displayed in top center of screen while in any mode		
1	Recall Frameline Position #1	"RCL 1" confirmation displayed on screen for 1 sec.	n/a	All position #1 settings recalled and displayed for Frameline, Cross Hair, Horizon, and Battery
2	Store Frameline Position #1	"SET #1" confirmation displayed on screen for 1 sec.	n/a	All position #1 settings stored for Frameline, Cross Hair, Horizon, and Battery
3	Recall Frameline Position #2	"RCL 2" confirmation displayed on screen for 1 sec.	n/a	All position #2 settings recalled and displayed for Frameline, Cross Hair, Horizon, and Battery
4	Store Frameline Position #2	"SET #2" confirmation displayed on screen for 1 sec.	n/a	All position #2 settings stored for Frameline, Cross Hair, Horizon, and Battery
5	FLG On/Off	Frameline display is toggled on and off	n/a	Frameline OSD is toggled on and off.
6	Graphics On/Off	Horizon, Cross Hair, and Battery OSD's are toggled on and off.	n/a	Horizon, Cross Hair, and Battery OSD's are toggled on and off.
7	Cross Hair position	Cross Hair graphic pulses on and off	Timed-out if no buttons pressed or activate EXIT mode	Cross Hair graphic can be moved anywhere on screen.
8	Horizon position	Horizon graphic pulses on and off	Timed-out if no buttons pressed or activate EXIT mode	Horizon graphic can be moved anywhere on screen.
9	Battery position	Battery graphic pulses on and off	Timed-out if no buttons pressed or activate EXIT mode	Battery graphic can be moved anywhere on screen.
10	Graphics Brightness	Entire frameline graphics pulses on and off	Timed-out if no buttons pressed or activate EXIT mode	Brightness adjustment of OSD graphics.
12	Lower & Left Frameline position	Lower and Left frameline graphic line pulses on and off	Timed-out if no buttons pressed or activate EXIT mode	Framelines can be moved anywhere on screen.
13	Upper & Right Frameline position	Upper and Right frameline graphic line pulses on and off	Timed-out if no buttons pressed or activate EXIT mode	Framelines can be moved anywhere on screen.
14	Frameline style select	A selection of frameline styles will be shown on the screen.	Frameline style changes to selected pattern after button press.	Selection between 1 of 4 pre-determined Frameline line graphics.
15	Cross Hair style select	A selection of cross hair styles will be shown on the screen.	Cross Hair style changes to selected pattern after button press.	Selection between 1 of 4 pre-determined Cross Hair graphics.
16	EXIT	n/a	n/a	Exit all modes and returns to main display.
17	Factory Reset	n/a	n/a	With both buttons pressed at power up, system is reset to factory default settings.

Note: Pure white graphics won't dim (mode 10). Choose a gray graphic or frameline if you want to dim it.

The Artificial Horizon

Adjustments, and displays

The Clipper artificial horizon has three controls – a button and two rotary switches. The button on the back of the electronics base controls the zero offset, direction, type of display, and horizon on/off. The switches are accessible via holes on the port side of the base. One switch controls the "range" of the display and the other the "rate."

The button on the back

Pushing the button for less than 1 second will reset the sled level (sets the "zero offset").

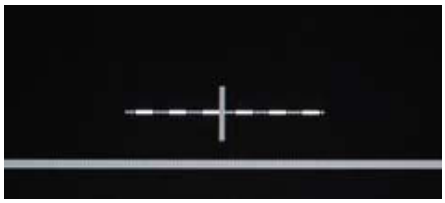
Place a small bubble level on a surface parallel to the bottom frame of your camera (usually the dovetail plate works well). Angle and hold the sled until this bubble reads level, then push and release the horizon button quickly. The display should now read "level."

Pressing the button for more than one second but less than three will flip the display direction – useful for going to low mode and back. The center two LED's on display will flash to confirm that a mode change has occurred. Be sure to re-set the zero offset when going to low mode and back.

Pressing the button for three to five seconds will switch the LED display from bar graph mode to "night rider" dot mode. Again, the center two LED's on the display will flash to indicate that a mode change has occurred.

Pressing the button for five to thirty seconds turns horizon system off or on. All LED's will be off.

Pressing the button for more than 30 seconds resets everything to default values.



On-screen level display — only available with composite video signals.

Level, UltraBrite$^{2™}$ Monitor

Off-level, "Night-Rider" mode

Off-level, "Normal" mode

Choosing a Range

The range switch sets the sensitivity of the display. The smaller the range, the more sensitive the display will be. The default setting is “0” or +/– 5 degrees. We suggest you experiment with settings 1 through 6. The range choices beyond 5 degrees might be useful if one wanted to hold a specific Dutch angle. Setting “F (15)” is the full range of the sensor.

Range Choices

Setting	+/- Degrees
0 (default)	5
1	2
2	2.5
3	3
4	3.5
5	4
6	4.5
7	5
8	5.5
9	6
A (10)	6.5
B (11)	7
C (12)	8
D (13)	9
E (14)	10
F (15)	180

The range switch interacts with the rate switch. Typically, the smaller the range, the less integration you will need. Ranges or rates significantly larger than the default values are not typically used.

Setting a Rate

The rate switch sets the integration (or averaging) time. The longer the integration time (the lower the frequency or Hz), the slower the system responds. A longer integration time avoids the big, erroneous signals as you accelerate or decelerate. The faster the integration time, the more the indicator will jump around. Experiment and pick the “rate” you like.

Rate Choices

Low Pass filter settings (6-Pole IIR filter)

Setting	Hz
0 (default)	5
1	0.75
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8
A (10)	10
B (11)	12
C (12)	13
D (13)	16
E (14)	18
F (15)	40

There are sixteen positions, from zero to nine, and A through F. The default setting is “0” which equals 5Hz, a good compromise. Position one (.75Hz) has the most integration and slowest response. Position F has the least integration and fastest response.

PowerCube™ batteries

The PowerCube batteries are 6.0 Ah, 14.8V. Please read the literature that comes with each battery and charger for details.

Clipper 324 normal, 24 volt, (two batteries in series)

Generally we use the battery in pairs, generating (nominally) 29.6VDC. It's best to use batteries that are roughly equally charged. Both batteries power the 14.4 volt DC to DC converter nestled between the batteries.

On the Clipper 324, the on-off switch has two positions, 12 and 24 volts. In the 12 V position, only the rear battery is connected and the DC-DC converter is disconnected.

Clipper 324, 12 volt only, (one battery)

For a lightweight, 12 volt running rig, you might want to remove the forward battery, and/or use one Endura 7 battery. (Use two 7's for a lightweight 24 volt rig).

The Clipper 312, 12V parallel

The LEDs on the battery mount will blink when the low battery threshold is reached. The circuit breakers in battery mount are the standard automotive type.

Discharge rate

As your Lithium-Ion PowerCube™ batteries are used, the voltage drops at a fairly regular rate. However, the sample 30 watt discharge chart shows some interesting information. Hot off the charger, a single battery will read 16.8 volts, but within a minute drops to 16.1 volts when under load. This is normal, and not a cause for concern or an indication of a weak battery.

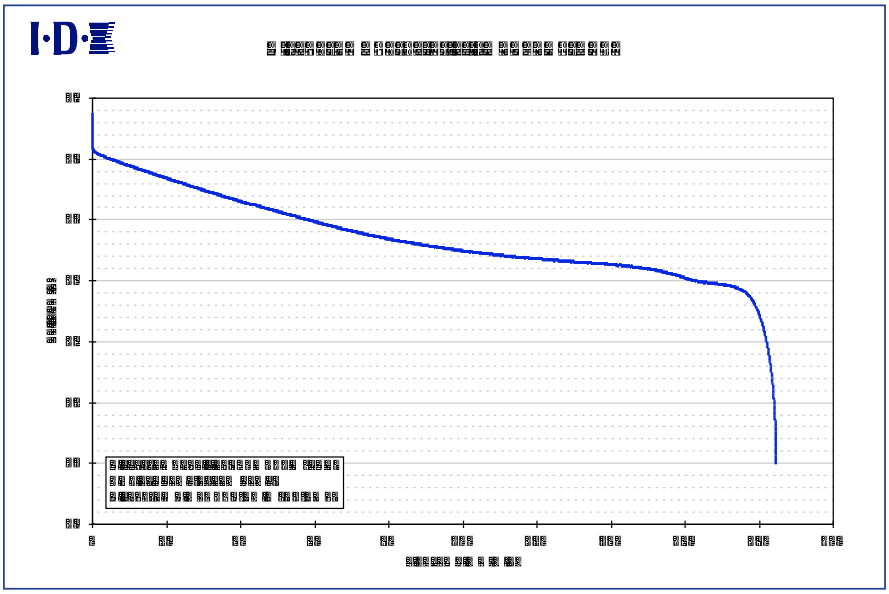
At the 30 watt discharge rate, the battery voltage drops slowly for about 3 hours from 16.1 volts to the "knee" voltage of 13.8 volts – slightly faster at the upper end, and more slowly as the battery is discharged. When the voltage reaches 13.8 volts, the voltage drops off very quickly to 11 volts (within 8 minutes). The batteries have a self-limiting cut-off of 11 volts.

Based on this discharge curve, we suggest you set the Clipper's battery warning at 13.8 volts if your total load is about 30 watts and 8 minutes is enough warning time.

If you are working with 24 volt film cameras, where the load changes when the camera runs, you might set the battery warning higher, to 28.2 or more volts for the two batteries in series, again depending on the load, how much warning you need, etc.

If the voltage drops below 26 volts when the camera is not running, you will not get any appreciable run time with most 35mm, 24 volt film cameras. See page 22 to see how to set the battery warning.

When running electrically noisy, or high current draw cameras or accessories, low voltage indicators may briefly appear. Voltage sag due to the large loads or excessive noise spikes on the power lines may surpass the threshold settings.



Charging your batteries

There is no memory effect with Lithium-Ion batteries. There is also no need to deep discharge your batteries to improve their response. Charging a completely discharged battery (11 volts) to fully charged (at 16.8 volts) with a 3.0 amp charge takes about 2 hours and 40 minutes, but the battery reaches 80% of a full charge (at about 16.5 volts) in just over 90 minutes. The last 20% of the charge cycle takes over an hour.

We suggest that if you have the time, fully charge your batteries. If you are in a hurry, however, charge them only for an hour and a half or less, as an 80% charge of these batteries is still a lot of watt-hours, and typically you are using two of them. Also don't discharge them much below 13.8 volts if possible.

If you have two of the VL-4S chargers, split the batteries equally between the chargers. Although all IDX VL-4S batteries are charged simultaneously, with one, two, or three batteries on the charger, the charge current is 3.0 amps per battery. When the fourth battery is added to the charger, the charge current for each battery drops to 2.3 amps, which will increase the time it takes to charge each battery.

Rotating mount

The battery mount pivots approximately 180º to facilitate static and dynamic balancing, and for inertial control. Pivoting the battery all the way down will enable it to get closer to the sled, reducing pan inertia and/or helping to balance very heavy cameras. Pan inertia is maximized with the batteries horizontal and the battery rods fully extended.

Accessories

*Supplied Accessories***

	part number
Camera mounting dovetail	802-7417
Blue Whale gimbal tool	800-7114
Gimbal transmitter	800-7150
Gimbal battery recharging cable	800-0101
Hard Case for sled	011-0355
8.4” UltraBrite HD monitor	800-7500-01
Power/Video cable for HD monitor	800-0102
Monitor Hood	252-7565
LX vest	800-7800-02
Soft vest bag	078-5237
Hard case (vest and arm)	011-0330
G-50 arm	800-7800-02
Soft arm bag	078-5236
G-50 anti-backlash tool	802-7265
T-handle 1/4” Allen wrench	MSC-093260
G-50 operating manual	LIT-800720
Docking bracket	250-7910
PowerCube™ 2+2 Starter Kit	FFR-000040
IDX VL-4S battery charger	FFR-000008
Battery hard case	011-0368
Stabilizing system: Vectran™ line	MSC-200100
3 ft video cable BNC	CBL-017715
12v accessory cable	250-0045
12v Power cable, camera, HD	078-7351-01
24v Power cable: Moviecam	078-7351-03
Pot adjust tool	MSC-104213
Allen wrench pocket tool	MSC-150890
Screwdriver	MSC-191115
Steadicam logo cap	FFR-000021
Spare ratchets with hardware	
Camera mounting screws,	
1/4-20	078-1121
3/8 - 16	078-1122
EFP Instructional Video	DVD-200504
Cap, Vinyl, 1/8 – 3/16 OD	MSC-300580
Cap, Vinyl, 3/8 – 7/16 OD	MSC-300581
Nut, 8-32 Hex, Thin	NUT-832010
8-32 x 1/2 Bind HD Slot	SCW-832006-1
Washer #8 Flat, SS	WHR-803
Washer #8 Split Lock	WHR-806
Warranty Form	LIT-077200
1” Buckle & Receptor	MSC-079901
T-Handle, 5/32 x 8.5 Hex	MSC-093270

***Available options and accessories vary by model.*

Recommended Cables and Accessories

Additional PowerCube™ Batteries	FFR-000035
Spare power/video cable for HD monitor	800-0102
Spare gimbal battery recharging cable	800-0101
Spare 3 ft video cable	078-4122-01
2 spare 12 ft video cables	
Spare 12v accessory cable	250-0045
2 each of all camera power cables you will use	various
RED power cable to 3-pin LEMO	802-0106
2 HD component cables, camera to sled	
2 HD component cables, sled to monitor	
Slanted F-bracket and safety pin	252-7906
Low mode handle clamp	078-7393-02
6 inch G-50 arm post	257-7202-2
Camera mounting dovetail	802-7417
Battery rod weights	800-7617
Follow focus rod mounting hardware and rods	250-7915
IDX VL-4S battery charger	FFR-000008
Tape measure	
Many spare camera screws:	
1/4-20 and 3/-16	078-1121/078-1122
monitor fuse	
Mitchell mount adaptor	800-7902

Also:

Wireless follow focus system
and brackets
Video transmitting and
receiving system
Wired zoom control system
Camera specific low mode brackets
Inertial augmentation
(Antlers™ or Gyros)
Video recording system

Cases & packing

When repacking the sled into the case, Insert the monitor first, with the rods angled up. Be sure that the sled length and gimbal position are properly set so that the sled drops freely into place, then rotate the monitor rods down into their final position.

Many operators cut the foam to accommodate accessories kept on the sled - such as a focus motor receiver or a small VCR. A long, thin razor blade works fairly well to cut the foam, as does a serrated knife.

The hard sled and vest cases have wheels and a retractable handle.

Soft bags are provided for the arm and for the vest, but you should also use the hard case when shipping your gear. Many other accessories are shipped in the battery case. Most operators have several other cases for their accessories, tools, low mode brackets, video recorders, video transmitters, diversity receivers, remote focus equipment, etc.

Attaching the Camera

Attaching the Camera

Camera c.g. .75” (19mm) behind center post – fore-aft.

Camera c.g. centered over post – side to side.

The basic idea: We want to position the camera’s center of gravity about .75 inch behind the centerline of the post fore-aft (as seen from the side) and directly over the centerline of the post side to side (as seen from the front or rear). We do this to facilitate both static and dynamic balancing. We fine-tune the placement of the camera as we balance the rig. See page 34.

First, center the side to side and fore-aft adjustments of the camera mounting platform, using the knobs, the remote control, or better yet, flip the centering switch to “C” and the motorized stage centers itself!

Attach all the accessories to the camera, including lenses, loaded film magazines, focus motors, obie lights, transmitters, etc. Don’t worry too much if you must add your motors or other accessories after you have attached the dovetail plate.

Using a rod or pencil, find the c.g. of the camera, both fore-aft and side to side. Temporarily mark this with pieces of tape.

Finding the camera’s fore-aft center of gravity.

Finding the camera’s side to side center of gravity.

Attach the long dovetail plate to the bottom of the camera, centered as closely as possible under the camera's c.g.
Use two screws to keep the plate from rotating.

If possible, attach a second dovetail plate to the top of the camera, directly above the other dovetail. This may require additional hardware, such as a special low mode bracket for your camera.

Place the camera above the camera mounting platform. Be sure the locking lever is fully open. Angle the left edge of the dovetail into the holder. Be sure to keep everything parallel. Lower the right side into the holder.

Dovetail locking lever fully open.

If the camera won't drop fully into place, be sure the left side of the dovetail is fully inserted, all is parallel, and the locking lever is fully open. It's a close fit.

After the dovetail drops into place, close the locking lever half way and slide the camera until the fore-aft c.g. mark is about .75 inches (19mm) behind the centerline of the telescoping posts. Post #2 is 1.580 (40.13mm) in diameter, so you can use the back of the post as a guide for placing the camera c.g.

Push the locking lever forward to fully lock the camera into place. You are now ready to static balance the sled.

Closing the locking lever.

Push firmly.

The dovetail locking lever has three positions (see page 8):

- 60° back is fully open and the dovetail plate can be inserted or released.
- At the half way or 90 degree position, the dovetail can slide back and forth for gross positioning of the camera. With the locking lever in this position, the dovetail can slide but cannot be removed.
- All the way forward is the locked position.

Tip: If you add your focus motors at this point, remark the camera c.g. If the side-to-side position drastically changes, you may have to reposition the dovetail plate on the camera.

Big, important tip: Wrap up, tie up, tie down, Velcro®, or gaffer tape all cables so they don't flop around and mess up your precise balancing. If you have cables that run to the outside world, leave them off at this point.

Static Balancing

Static Balancing

First, extend the posts and position the monitor where you want it, then find the proper position for the battery and camera for static and dynamic balance.

Static Balancing

The Steadicam sled should be carefully balanced to help the operator get the shot. Before balancing, the sled should have the camera and battery attached, all cables secured, and all accessories on board. The gimbal should be near the top of its post.

First we position the monitor to the best possible advantage. We want to be able to see the image and we want it to create the proper balance and inertia for the shot. Experience will help, but here are some general rules.

Extend the monitor horizontally to increase pan inertia.

Bring the monitor closer to the post for a quicker, “hand-held” feel.

Lower the monitor and/or extend the posts to balance a heavy camera, gain lens height, and/or to increase tilt and roll inertia (or all three!!).

For normal operating

Mount the gimbal on the balancing stud. Even if your C-stand has plenty of sand bags, it’s a good idea to have an assistant hold the C-stand.

The posts and the monitor bracket should all be properly aligned. Check the index marks on the posts. Release the proper clamp and rotate any section that is out of alignment.

You need to balance the sled in all three axes: fore-aft, side to side, and top to bottom. Pick the most out of balance axis and get that close to being in balance, then work on another axis. You may have to go back to tweak the balance in any given axis several times.

With the camera and monitor set, release the two battery rod clamps and pull out the battery until the sled balances upright. Balance as best you can with the battery – do not move the camera or monitor – then tighten the battery rod clamps.

To adjust top-to-bottom balance, tilt the sled until it is horizontal. Hold the sled firmly and release the gimbal clamp. Slide the gimbal until the sled balances horizontally - but never allow the sled to move from horizontal with the gimbal clamp open. Slide the gimbal up towards the camera about 1/2 inch or 1cm and lock the gimbal.

Now let the sled rotate (drop) through vertical and note the time. A two second drop time is a good starting point. 2 to 4 seconds is typical. Raise or lower the gimbal slightly to get a faster or slower drop time. (Again, only release the gimbal clamp when the rig is horizontal!!) A different drop time is required for long mode shooting. See pages 52-53 for details.

To fine tune fore-aft and side to side balance, use the knobs on the camera mounting stage, or use the remote control.

When the sled is very bottom heavy, it has a quick drop time and it will require bigger movements of a weight (camera or battery) to properly balance the sled. When the sled is nearly neutrally balanced top to bottom, very slight movements of any component will have a large effect on balance.

Tip: When adjusting the balance fore-aft or side to side, moving any weight "up hill" makes the sled hang more vertically.

Working with a Very Light Camera

With a fully compressed sled and a very light camera, the gimbal can get very low on its post (post 2), causing the arm to hit the electronics module. There are several basic strategies to raise the c.g. of the sled and consequently, raise the gimbal.

First, be sure the battery is rotated up. If you can, use only one battery (12 volts).

Next, try raising the monitor as high as possible while leaving the sled length the same. Raise the gimbal close to the stage. Slide the upper monitor mount to the top of post 3, and attach the monitor. Release the clamps at the top of posts 3 and 4 and slide post 3 up to the gimbal. Lock post 3 in place, and then lock post 4 to maintain the minimal sled length.

Re-balance top-to bottom.

An additional strategy: Add weight to the top of the camera, or a little more weight to the bottom of the camera. A weight cage works great in this context. Added camera weight will raise the c.g. of the sled, allowing the gimbal to rise towards the camera.

The last resort is to lengthen the sled. While the c.g. will continue to move away from the camera, the distance from the electronics to the c.g. will increase even more, so the gimbal will move away from the base.

The real downside (or opportunity, if you will) of this strategy is the increased gimbal to camera distance. While not good for most operating, it's great for super high or super low mode, or if you need more inertia in the tilt and roll axes.

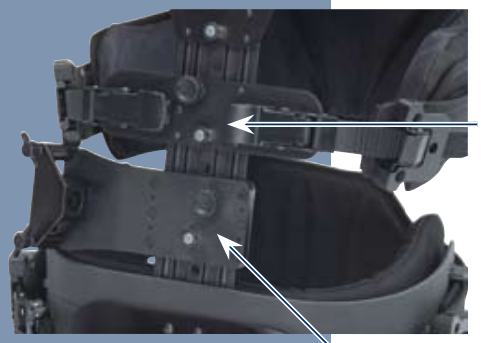
Tip: To speed up the process of side to side and fore-aft balancing, hold the sled vertical with your operating hand on the gimbal. Hold the gimbal the same way you would do while operating. Hold the sled absolutely vertical as you adjust the side to side or fore/aft balance. Turn the adjustment knobs with your other hand (or use the remote) until you feel no pressure on your operating hand, and the sled will be in static balance.

A different sort of strategy is "low high mode," explained on page 57.

The opposite of all the above is true if you have a very heavy camera and can't get the gimbal high enough – you want to rotate the batteries down and get the monitor as low as possible on the mount on post 4, bringing the sled's c.g. within range of the gimbal. You may also use this strategy to get the gimbal further from the stage – great for low mode.

The LX Vest


Shoulder pads
Shoulder connector
Chest pads
Chest straps
Socket block
Hip pads
Hip straps
Adjustable buckles


Adjustable spar release and pin
Socket block height adjustment


Adjustable Velcro® straps
Lower back pad

Fitting the Vest

The vest is the major connection between your body and the Steadicam. It must be adjusted properly and feel good on your body. The vest is not intended to be a **straightjacket**. You should be able to move and breathe easily.

The socket block for the arm should move with you and not shift under load.

The overall length should be adjusted so that lifting your legs while taking a step up doesn't disturb the vest. The hip pads should comfortably grab your hips.

Note: A few operators have body shapes or sizes that are out of the general range of adjustments. You may find you have to add or remove padding, shorten or extend straps, etc. to make the vest fit perfectly.

Available options: a compact vest, and longer chest, hip, and cross back straps.

Tip: While wearing the vest and resting between takes, release the vest straps to increase blood flow and ease tension in your muscles.

Start at the top

- Be sure the shoulder pads are firmly down on your shoulders.

- The chest pads are snugged up next. You should be able to breathe a little, but the vest should not be able to slip forward and down. Diaphragmatic breathing (like a baby) works best.

- **Push the vest down on your shoulders again,** be sure the spar is vertical, then snug up the hip pads. If the hip pads are tightened first, the vest will tend to ride high until loaded, and then it will slip around under load.

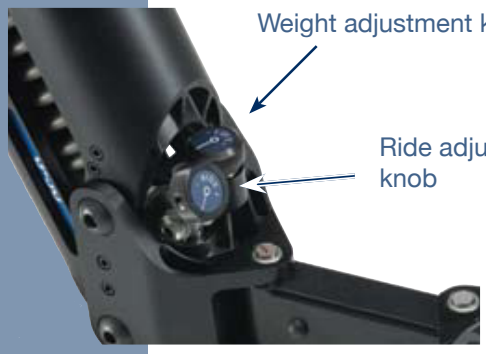
- Closing the clips on the hip and chest straps is the final step.

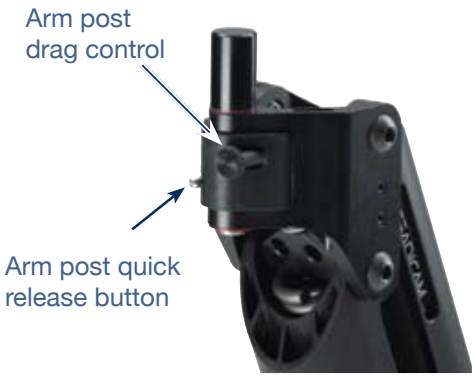
- Pay close attention to the good fit of the vest in the photo (left). It's very important how the shoulder pads contact the shoulders and the shoulder connectors are not too high (a common mistake).

The G-50 Arm

The G-50 arm has a total lifting capacity of 10 to 50 pounds (5.4 - 22.7kg) and a 32” (81.3cm) boom range. The arm also incorporates a ride control, a quick post change mechanism, and an arm post drag control.

Use the flat tool if there is any play in the vertical adjustment of the arm.





The G-50 arm socket is inserted into the socket block on the vest.

Using the G-50 arm requires three sets of adjustments:

- The first is setting your threads, so the arm lifts at the proper angle.
- The second is adjusting the arm's weight carrying capacity, which varies as you change cameras or accessories.
- The last is setting the iso-elastic performance or "ride" of the arm, an adjustment unique to the G-type arms.

Your Personal Threads: The Arm-to-Vest Lift Angle

Setting your threads is part of basic operating technique. Two 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 "personal" as they adjust the arm lift angle to your body's shape and the way you wear your vest.

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. Getting the proper threads is critical for good operating.

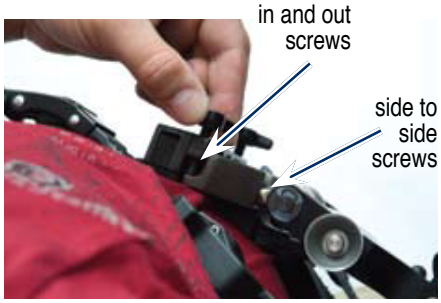
Side to side

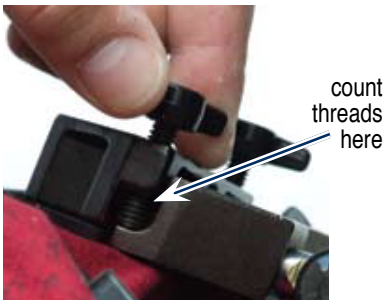
For almost all operators, regardless of body type, the typical adjustment for the "side to side" screws (i.e., the rod ends in the arm) is 2 to 2.5 turns out on the top screw and ALWAYS all the way in on the bottom screw. These side to side screws work independently of one another. Do not tighten the lower screw, but be sure it is all the way in, and then back it out 1/8th of a turn to prevent binding.

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.

In and out

While 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. The "in-out" adjustment on the socket block varies greatly by the operator's body type. If you have big pectorals 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.

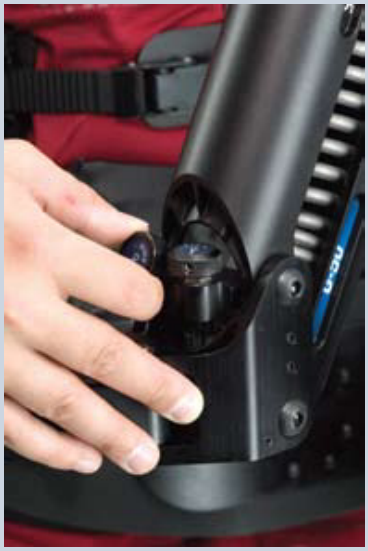




Always dial in the top screw first to your setting, then turn in the bottom screw until it just snugs up against the fitting. There is no need to tighten the bottom screw very hard. With both pairs of screws properly adjusted, the camera will float in all positions with the operator standing relatively comfortably.

These suggestions will get you close to your final "threads."

After you pick up the Clipper, you must fine-tune all the adjustments: your threads, the ride, and the lift. While the lift and ride settings will change as you change cameras, lenses, accessories, etc.., your threads do not change regardless of what you are carrying.



Adjusting the ride: the arm must be angled up at the top of its range.
Note: the ride knob is horizontal, the lift knob is vertical.

G-50 Arm: Ride and Lift

Each arm segment has two adjusting knobs:

The Ride knob alters the arm's performance from a hard, centered ride to an ultra-effortless, iso-elastic ride. Most operators prefer an iso-elastic ride.

The Lift knob adjusts lifting power continuously from 12 to 50 pounds (5.4 to 22.7kg).

Adjusting the "Ride"

Ride is a new feature and it takes a few minutes to understand how it works, and how to make it work for you.

The G-50 arm has an active "Geo" link that changes the spring tension as the arm booms up and down. The link creates both a smoother ride and an extended boom range compared to other arms. The link also is adjustable, giving the operator the ultimate control over the arm's behavior or "ride." You can make the arm extremely iso-elastic or you can make the arm seek the center position more strongly.

In general, you want to make the arm as iso-elastic as possible, so you do less work.

As the arm carries more weight, the iso-elastic feel will change. Turn the ride control knob counter-clockwise to maintain the iso-elastic response.

A heavier rig needs "more" iso, and a lighter rig needs less.

Ride can only be adjusted when the arm segment is raised to its highest, unloaded position, so it is easiest to adjust before you pick up the sled. It can also be adjusted when carrying the sled by booming up fully.

If you can, preset the Ride close to the desired level of iso-elasticity in both arm sections before picking up the sled. Start by presetting the Ride knob to the middle of its travel (about 20 threads visible). Once you get the iso-elastic feel you like, make a note of the threads and the camera weight for future reference.

Turning the Ride knob also has a slight effect on the lifting power of the arm.

The stops at both ends of travel of the Ride knob should not be forced.

To set the ride control for the maximum iso-elasticity:

- Set the arm to carry the sled's weight
- Be sure to stand in proper form
- Boom the arm section all the way up to adjust the ride control
- Unscrew the ride control knob a few turns at a time and test by booming up and down.
- At some point, the arm section will begin to lock up as you boom up. When it does, screw the ride control knob back in a couple of turns. Repeat for the other arm section.
- If you change the weight of the rig significantly, change the ride control. A heavier rig needs more "iso" and a lighter rig needs less "iso."

Adjusting the "Lift"

All lift adjustments must be done while wearing the rig. Stand in the classic Missionary position and properly set your threads before proceeding.

Adjust the "forearm" section first (the arm section closest to the gimbal). Hold the arm segment slightly above level. When the lifting spring is perpendicular to the adjusting mechanism, the spring force is neutral — neither up nor down — reducing the effort needed to turn the knob.

Slightly raise or lower the arm segment to find the sweet spot. Adjust the arm's lifting power so that the arm section seeks a position slightly above horizontal.

When the forearm section is set correctly, adjust the upper arm section to follow (track with) the upper arm section as you boom fully up and down. At this point, do not worry if the arm tends to lock up or down.

Note that the Lift knob has a range of adjustment of 30 turns. This means that each turn of the Lift knob will add or subtract about 1.3 pounds (.6 kg) of lift.

Some arm adjustment tips:

When adjusting from a light load to a heavy load: It helps to have an assistant independently control the height of the upper arm and make his lift adjustment at the same time as you adjust the forearm lift. It also helps if you raise your docking stand so you can stand next to it and insert the arm post into the gimbal yoke of your docked sled with your heavy camera aboard. As you and your assistant adjust the lift of both arm segments, they will gradually pick up the weight until it floats free of the dock. When adjusting from a heavy load to a light load: Leave the heavy load aboard if possible, and with the sled on the stand, remain adjacent to the stand while you lighten the lift of both arm sections at the same time. Then remove the heavy weight and rebalance the sled for the light camera and then see if the lift needs further adjustment.

Some operators will set the arm sections at a higher nominal angle (+20º or more), to minimize any lifting required with heavier cameras and/or high boom heights. Pushing down is easier than lifting fully with the extended boom range possible with the G-50. The arm can also be adjusted to hang lower than normally for shots with low boom heights, with very little penalty in performance.

Finally, re-adjust the Ride knob for the desired iso-elastic response

With the arm set to carry the load, you can micro-adjust Ride for any given load.

Typically, the arm is very forgiving of less than "perfect" adjustments of lift and ride. Minor changes in sled weight (+/- several pounds) do not require adjustment of the ride knob. Some operators prefer a more centered ride (like a IIIA arm with a less than maximum load), or a more centered ride when hard-mounted on rough terrain. Experiment and use the arm the way you like it.

Note: Lift can be altered by forcefully holding the arm segments at the correct angle while adjusting, but be prepared for some exertion! You might be shocked how energetic the springs feel if you are raising or lowering the lift by 30 pounds (14kg)!

Goofy foot

If you want to operate “goofy-foot,” — with the sled on the right side – you will need to reverse the socket block, flip the arm mating block and reset your threads.

On the LX vest, loosen the three clamping screws for the front yoke, the chest straps, and the socket block plate. You may have to tap the plates hard with your fist to get everything to release. Pull the pins and slide the plates off the spar. Flip the socket block plate, then reassemble the vest and retighten the clamps.

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, use a 1/4” allen wrench and turn the lower side to side screw all the way in, then adjust the upper screw to your threads – about 2 to 2.5 turns out. Use the same procedure to change back to normal (left) side operating.

Working with arm posts

General uses

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

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. This increases the gimbal height (and therefore lens height) - up to seven and a half inches (19cm).

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, (all without tools!) gives the operator many choices to achieve a given range of lens heights and viewing options.

Rotational drag

To set the rotational drag, turn the drag knob clockwise to increase drag and counterclockwise to decrease drag.

Changing arm posts

To change arm posts, push the button to release or to insert the arm post as shown.

Dynamic Balancing

A Steadicam sled is in dynamic balance when the center post remains vertical as the sled is panned (and this is critical) at any and all panning speeds..

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.

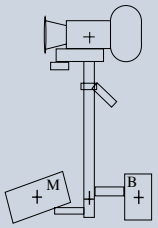
Dynamic balance can easily and quickly be achieved by the trial and error method. You can also use the Dynamic Balance Spreadsheet on your computer.

In all cases, when a sled is in dynamic balance, both the camera's c.g. and the battery' 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 and place the monitor where you want it for proper viewing and inertial control. Position the camera so that its c.g. is about .75 inches (19mm) behind the center post. The center post is 1.580 inches (40.13mm) in diameter, so you can use the back of the post as a guide.

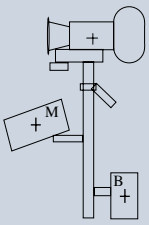
Three figures to study for understanding dynamic balance

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.



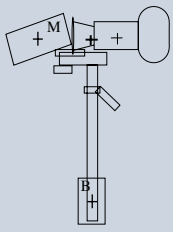
The second figure has the monitor raised a bit. This looks like most Steadicam configurations, high or low mode. Note that the battery c.g. is closer to the post, and the camera c.g. has moved to the rear. Why?? See the third figure.

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

It typically works out that the camera c.g. is pretty close to .75 inch to the rear — a bit more if the camera is light or the monitor is higher, and somewhat less if the camera is very heavy or the monitor is lower.



Next, static balance with the battery so the sled hangs perfectly vertical fore and aft. Use a slow drop time (3 – 4 seconds).

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. Double check that the post is perfectly vertical. Give the sled several careful test spins. Very important: do not spin the rig very fast – certainly not much faster than a normal panning speed (3 – 6 rpm).

Note the results. Is it good or bad, panning flat or wobbly? Is it your technique or is the sled out of dynamic balance?

To get the sled into dynamic balance, do not move the monitor! You put it where it is for a reason, so leave it there. Move the battery a little bit first, then rebalance with the camera.

There are only two directions to move the battery, in or out. You have a 50% chance of choosing the right direction, so stop worrying about it and give one direction a test. Just be sure to make a note of which direction you move the battery.

After you lock the battery in place, you must rebalance the sled statically with the camera. Do not move the monitor!

Once you are in static balance, spin the sled again. Is it better or worse? Again, you have two choices for moving the battery. 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 (6mm) of ideal, the sled will behave nicely and feel "sweet."

We suggest you do not attempt to do this for the first time on set!

Adding any accessory to the sled will affect both static and dynamic balance.

Changing the length of the sled, and/or moving the monitor in, out, up, or down will change both static and dynamic balance.

How much will dynamic balance change? It depends on the mass and position of the new 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.

In practice, it's a lot easier than it sounds on the page, and luckily, there's one great gift in all this: it doesn't matter for dynamic balance what weight camera you are using or if you change lenses, filters, tilt the head, etc. Really!

So if you make any changes with the camera, there are no worries about getting back in dynamic balance! You only need to rebalance statically and you will be in dynamic balance again. Honest.

Put the other way around: you can set up your rig in various ways (long short, monitor high or low, extended, etc.) with a practice camera at home, make note of the positions of the monitor and batteries, and be able to get into dynamic balance quickly on set, regardless of the camera or accessories you might carry. Really. Honest. No fooling.

For the complete story, see the Dynamic Balance Primer and play with the Dynamic Balance Spreadsheet, available online at www.steadicam.com.

Three tips:

- The monitor pivots close to 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.
- Changing lenses or adding accessories to the camera (or even changing cameras) will not mess up your dynamic balance. Just re-balance statically (rack the camera) and you will be back in dynamic balance.

Make sure to give it an even spin. Use your thumb and first finger up at the gimbal.

Spinning a bit wobbly.

Looking good!

Inertial control

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

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.

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.

Clipper at maximum horizontal extension.

Experiment to become familiar with all that happens as you move components around.

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.

You have a lot of choices built into the Clipper. Experiment at home and become familiar with the consequences of any change. Then use the choices to help you get the shots you want.

Some actual numbers for the Clipper 324 (UltraBrite² monitor)

The monitor and yoke weighs approximately 4.8 pounds (2.17kg). The two batteries, the mount and the converter weigh 4.6 pounds (2.09kg).

In the maximum configuration, the monitor's c.g. is extended 17 inches (43cm), the battery pack's c.g. is extended 16 inches (41cm), creating a total of about 2,564 pound inch² (17680Kpa) in the pan axis.

In the minimum configuration, as shown, the monitor is extended 5 inches (13cm) and battery 5.5 inches (14cm), creating only 259 pound inch² (1786 Kpa) — almost 10 times less angular resistance in the pan axis. We love the square law!!

If you remove one battery for a 12 volt rig, flip the battery down, and push the battery pack all the way in, you can reduce the pan inertia even further - to 139 pound inch² (958 Kpa)!

If you want a slow rig, or need the shot to be as stable as possible, spread the masses far apart.

If you want a quick, fast panning and tilting rig, bring the masses in as close as possible to the gimbal.

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

Clipper at minimum horizontal extension.

Minimum pan inertia with one battery.

Low Mode

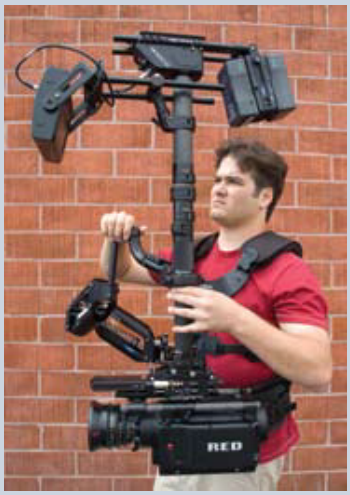
Tip: Many video cameras - or video cameras with film lens adaptors – do not have a proper way to mount a dovetail above the camera. We suggest you use the "bottom" dovetail for low mode, shooting upside down. You will need to flip the image in post production, so be sure that's possible before you shoot.

You can either leave the monitor upside down, or physically flip it over for better viewing. The latter will require electronic flipping of the image. See the monitor section for instructions.

Configuring the sled for low mode

In order to configure the sled for low mode operating, you must:

- Flip the monitor and the camera upside-down.
- Attach the optional slanted F-bracket (P/N 252-7906) to the gimbal.
- Rebalance the sled, both statically and dynamically.
- Re-set the electronic level.
- You also might change the post in the arm and/or raise the socket block on the vest to restore some of the arm's lost boom range.



The camera will need some means of attaching a second dovetail to the top of the camera (P/N 802-7417).

A low mode handle clamp (P/N 078-7393-02) works for some cameras, but be sure the camera's handle is strong enough. Many plastic handles on video cameras are inadequate, and a custom cage or bracket is required.

Many film cameras come with dedicated low mode brackets and 100% video viewfinders. Some camera-specific low mode bracketry might also provide a means of mounting motor rods (or a dovetail with motor rods), and this system should not interfere with camera functions or working with the camera in high mode.

Most operators work with the low mode bracketry and second dovetail in place — ready to go at all times.

Attach the second dovetail directly above the first dovetail. Check that it does not interfere with changing mags or any other camera functions.

Remove the monitor mount and flip to low mode

Always support the monitor. Loosen the Kipp handle, depress the safety button, and slide the monitor bracket straight up or down. To replace, engage the monitor bracket with the dovetail squarely and slide it down until the safety clicks in. Tighten the Kipp handle. The monitor will be square to the post.

By design, the monitor c.g. does not change when you flip it over. Therefore, if the sled length does not change, dynamic balance will be preserved.

Balance the Steadicam

The sled can be balanced the same as in high mode. Hang the rig by its gimbal on the balancing spud. The camera will still be on top, but it is upside down. Balance statically and dynamically. Once balanced, adjust your drop time so the camera now falls to the bottom of the rig: simply move the gimbal toward the ***electronics*** to achieve a proper drop time.

Cautionary Tip: In low mode, the dovetail lock works better if the camera weight is supported as you lock the dovetail.

Adjust the electronic level

Place a spirit level on the camera. Hold the sled level and push the level button quickly. Pushing the “level” button on the sled for less than 1 second will set the level; pushing and holding the level button for 1-3 seconds will alter the direction for low mode. (See pages 26-27 for a full description of the Artificial Horizon.)

The slanted F-bracket

There are two positions for the F-bracket, one for regular side operating and one for goofy-foot. Be sure to angle the F-bracket away from you (about 45 degrees forward) when standing in the Missionary position.

regular operating

goofy foot operating

without f-bracket

Without an F-bracket, the end of the arm will be next to the camera. Switches are impossible and operating is severely limited.

with f-bracket

The F-bracket brings the arm back into a proper relationship with the inverted sled.

Tip: In very long and low mode operating, the F-bracket can be omitted, as there is plenty of room for the arm.

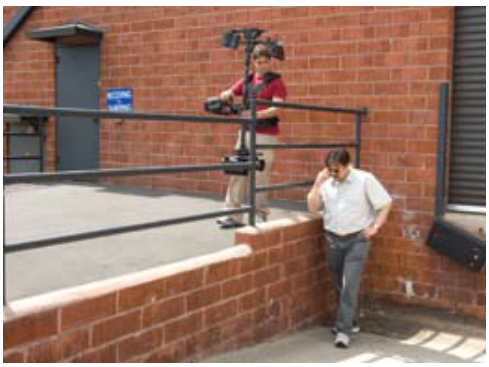
Low mode operating

Traditionally, it's considered harder to operate in low mode than in high mode. Why?

Several factors may work together to make low mode operating harder. The operator usually holds the sled further from his body than in high mode. The operator's hands are not at the same height. Many times, the post is tilted from vertical. The boom range is sometimes reduced. The rig may not be in dynamic balance. The operator often cranes his neck to see the image. In addition, every director wants the lens height lower or higher than one can properly reach. And it's just plain weird to have the monitor so far above the lens.

A useful trick

The range of low mode lens heights can be lowered by making the rig more bottom heavy. With this trick – and the unique design of the Clipper's telescoping post – even a very heavy camera can kiss the ground. In fact, if one didn't care at all about bottom heaviness, the top of the camera could be almost two feet below the gimbal.



To make low mode operating easier and more precise:

Use the tilt head to keep the post more vertical and to make viewing the image easier. Use the new F- bracket to reduce the hand height differential and to have fewer clearance issues with the post. Use the telescoping post system and different arm posts to set the proper lens height range and to restore the full boom range of the arm.

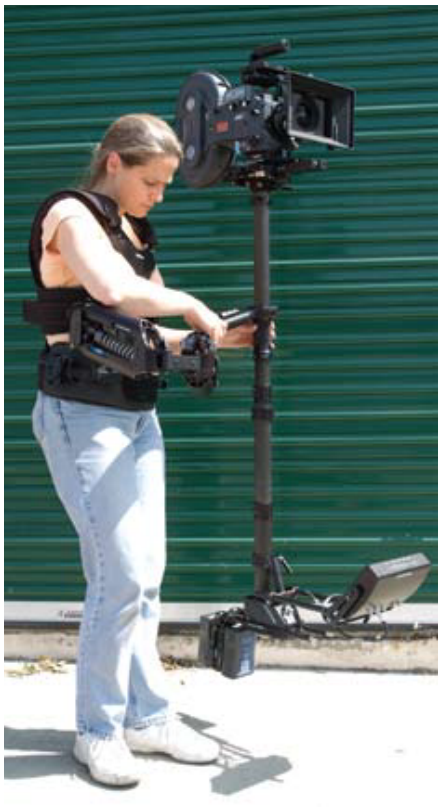
Be sure to rebalance dynamically as well as statically. Dynamic balancing is often ignored because it's next to impossible to spin balance in low mode, but dynamic balance is critical for precise work.

Fortunately, the Clipper is easier to get in dynamic balance in low mode than any other Steadicam. If the operator does not change the length of the sled or the monitor position, the sled remains in dynamic balance. (Remember, the monitor tilts and flips on its center of gravity.)

But one still has to hold the camera further from one's body, and the monitor is still above the lens. So practice until low mode is as easy as.... it can be.

Long Mode Operating

Long mode operating presents some wonderful opportunities and hazards. Unusual lens heights, both high and low, is the principal allure of long mode operating.



The tool-free clamps make it easy to extend or compress the integral post system, and also to configure the monitor and battery to best advantage for the shot. The tilt head makes long mode operating practical.

Most operators are used to working with relatively short sleds. As the telescoping posts are extended, new factors must be taken into consideration. Viewing, clearances, increased inertia, inertial imbalances, static and dynamic balance, and flexing are key issues.

Increasing the lens height by extending the telescoping post may be the only way to get the lens height you need. It may also get you better viewing of the monitor or a needed increase in tilt and roll inertia – or all three!

The standard “drop time test” that is typically used to determine bottom heaviness should be ignored.

Instead of using a drop test, tilt the Steadicam with your operating hand and note how much force is required to tilt the sled. Compare this force to what you use to tilt a normal, short sled. It should be similar. Try accelerating and stopping the rig and note the pendular action. Again, adjust the bottom heaviness accordingly, depending on the requirements of the shot.

The operator dynamically balances a long sled using the same procedures as with a shorter sled. The trial and error method is fairly quick. However, because there are so many possible configurations with the Clipper3, spin balancing for each one

can be time consuming and unproductive. Use the Clipper Dynamic Balance Spreadsheet to virtually discover how to get your rig into dynamic balance under various conditions.

Very long sleds have a lot of inertia in tilt and roll. It takes time and effort to tilt or roll — and time and effort to stop a movement you've started. Although the sled may be harder to get off-level, it's also harder to get it back to level once you've strayed.

With the monitor fully in — which might be desirable for quick panning — the pan axis will feel very light compared to the tilt or roll axis. To make the sled feel more "normal" (or inertially balanced in all three axes), extend the monitor fully and extend the battery for dynamic balance. Extending the monitor and battery adds a lot of inertia in the pan axis.

A long post configuration adds lots of inches to the bottom of the sled. Operators tend to pay attention to the lens, and they may be surprised when that other part of the sled strikes something on the set.

Panning the camera when a long sled is angled up or down requires that both ends of the sled move in great arcs. This spatial translation of masses is very hard to control.

The uselfulness of any long mode sled is greatly enhanced by the addition of an integral tilt head and a motorized stage. Use the tilt head to keep the rig more vertical, reducing the spatial translations, and, at the same time, reducing clearance problems between the sled and objects on the set.

Use the tilt head to keep the sled in dynamic balance — always a plus.

In the most expanded high mode, the bottom of the sled can be as much as 46 inches below the gimbal.

The operator also needs to get used to the increased distance from the monitor to the lens.

Tip: Avoid violent moves with long sleds. The stresses can be very large.

Attempting a long mode pan with an Ultra^2:

with a tilt head — without a tilt head

Without a tilt head and the lens angled up or down, precise panning becomes nearly impossible, due to the huge and odd spatial translations of the sled. The faster the pan, the worse it gets. The camera is tilted 15 degrees up in both cases.

Lens height and the telescoping post

Just how high or low a lens height can you get?

As a rough estimate, in high mode with any camera, you should be able to get a lens height of about 6.5 feet (2m). If you are tall and using a light camera, a lens height of 8 feet (2.4m) is possible.

Maximum lens height

To get the maximum possible lens height with any camera:

- Extend the bottom two sections (posts #3 and #4)
- Fully lower the monitor all the way down on the mount on post #4.
- Rotate the two batteries straight down.
- Position the gimbal at the bottom of post #2.
- Static balance the rig top to bottom by moving the gimbal. The lighter the camera, the lower the gimbal will be and the greater the lens height.

To gain additional lens height, use the long arm post (optional, + four inches) in the arm and also position the socket block as high as you can on your vest (+ 3 inches/8cm). If you can carry additional weight, add it to the bottom of the sled via the integral dovetail, and use the stainless steel battery rod weights.

This is the arrangement of components that creates the maximum lens height. The greater the distance between the counterweights (battery, electronics, and monitor) and the camera, the more the c.g. and pivot point move away from the camera. The heavier the camera, the less effective long mode will be. Or, the lighter the camera, the better.

But how high can one get the lens?

Alas, the answer isn't easy. The exact lens height you can achieve with the Clipper depends on your height, the camera weight, and how much additional weight you are willing to carry at the bottom of the sled.

A useful accessory: specially made stainless steel rods that fit perfectly inside the battery rods. The two rods weigh .75 pounds (.34kg) and screw tightly into place. The low position of these weights raises the camera by lowering the c.g. and therefore gimbal. (The weights can also be used to keep the sled shorter.)

Establishing the primary gimbal height range with the short post in the arm

Note that the operator can reach higher with his operating hand, but the arm can't reach any higher. Do this with the arm attached to the socket block at its lowest practical point on the vest, and with the short arm post. This will generate your primary range of gimbal and lens heights. You may find it useful to have someone measure this range of lens heights.

A practical application for knowing your range of lens heights

Although it's nice to know the range of lens heights you can achieve while standing, here's one application where the knowledge is critical.

Hard-mounting to a vehicle or dolly takes a lot of time and effort. If the shot calls for a specific range of lens heights, you want to position the socket block at the right height, with plenty of boom range up or down, the first time you try.

Here's the technique:

As part of determining the primary range of lens heights, also measure the height of the socket block on your body. Subtract that from the lens height range to create a range of lens heights relative to the socket block. Create these ranges for both high and low modes, and you can use the information to correctly set the hard mounted socket block the first time around. (It's always a good idea to keep the grips happy.)

Lens Height — High Mode

Normal range for high mode with short arm post. Range is different if operator is taller or shorter.

The boom range of the G-50 arm is 32 inches (81.3cm). While wearing the rig, the operator can stretch up a bit while booming up and scrunch a little while booming down, so the practical boom range is 34-35 inches (86-89cm). When still, one can bend the knees or sit down to get the lens even lower.

You can change your lens heights in many ways

The basic tools are: raising the socket block, using a longer arm post, using an F-bracket, making the sled shorter or longer, flipping to low mode, and any combination of these techniques. Each technique has its advantages and disadvantages; it's up to you to decide which technique works best for the shot.

One easy way to shift the arm's boom range is to raise the socket block on the vest. It's not a big change (3.5" or 9cm), but it might be just enough and there's no real operating penalty or compromise.

Another easy way to raise lens heights is to use a different length post in the arm. With a G-50 arm, the longest arm post you should use is six inches (P/N 257-7202-2). A longer arm post could damage the arm, especially with heavy cameras or riding in a vehicle.

You can also extend the telescoping post and balance the rig with the camera further from the gimbal. How much of an increase in lens height you get depends on how heavy the camera is, and how much weight you are willing to add to the bottom of the sled. This mode is often called “super-high mode” or “long high mode.” It depends on the level of hype you want to use.

Trying to fly heavy cameras in long mode (high or low) will be disappointing. There is very little additional lens height for a huge increase in sled length. Light cameras are Steadicam friendly in many, many ways.

Low high mode

We can use the F-bracket in high mode to lower the range of lens heights. It’s sometimes called “low high mode.” How low we go is often a function of how low we can reach.

regular high mode

Lens Height — Low Mode

Using a 6” (15cm) arm post (above) increases lens height, but long mode (below) can radically change the range of lens heights.

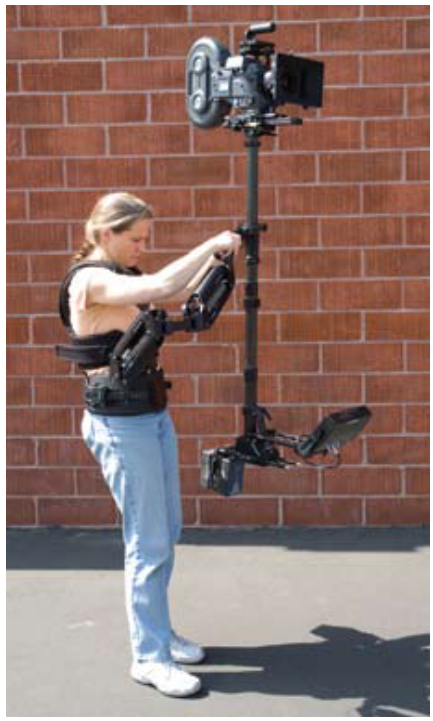
We typically use the F-bracket to bring the arm back into a proper relationship with the sled so we can pan, tilt, and make switches without hitting the camera.

In low mode, we typically raise the socket block and add longer posts to raise the range of heights and restore the full boom range of the arm. If we don’t use these techniques while in low mode, we cannot reach the gimbal at the bottom end of the arm’s range, and therefore we are wasting precious boom range.

A long post in “normal length” low mode may make the arm interfere with the sled again, so you must test how long a post you can use.

Very long low mode configurations don’t require an F-bracket for clearance. Not using an F-bracket is just another easy way of raising the range of lens heights.

low high mode



Note: The short post in the F-bracket should *never* be swapped out for a longer one.

Maintaining Lens Height — Long Modes

We use the tilt head to maintain our high or low lens heights. Especially in long mode operating, the precious lens height quickly disappears as the sled is tilted.

Example 1:
Without a tilt head.
Camera angled 15° down.

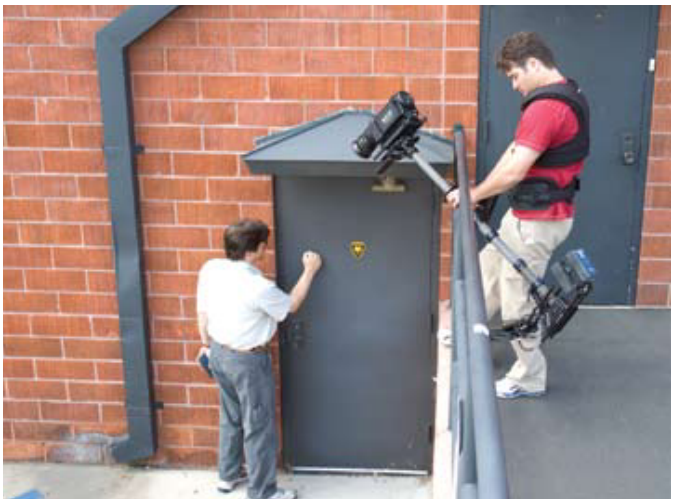
Example 1:
Same shot, with a tilt head.
Note that the post is vertical, the lens is higher, and the monitor is in a much better viewing condition.

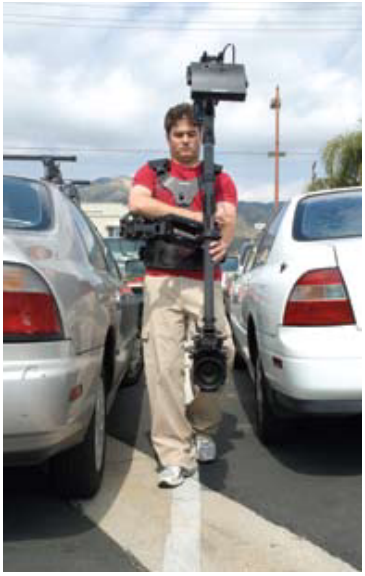
Example 2:
Without a tilt head.
Camera angled 30° down.
The monitor is in a really awkward position now.

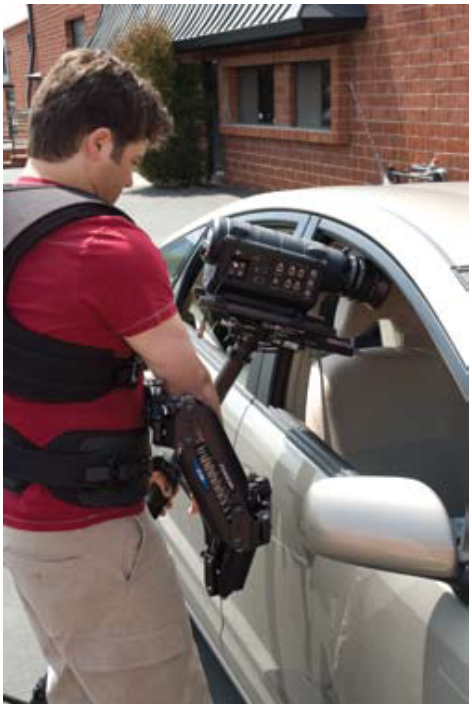
Example 2:
Same shot, with a tilt head.
Again, the lens height is greater with the tilt head.

Other Applications

One of the more unusual applications of the tilt head is to angle the sled and its components relative to the desired position of the lens. Moving the sled relative to the lens might avoid casting shadows into the shot, seeing one's own feet, or prevent the sled from hitting something on the set.







The Stiffening System

Any long post Steadicam sled, whether single or multi-section, suffers from increased flexing. The longer a post, the more it flexes — unfortunately by the cube law. Doubling the post length makes the rig eight times more flexible!

The carbon fiber telescoping post is very stiff, but it will need extra rigidity under certain situations. The heavier the camera or the more violent the moves, the more help is required.

The stiffening system consists of attachment points on the monitor, the battery mount, the bottom of the sled, and just underneath the tilt head; and a length of lightweight Vectran™ line.

Vectran™ is a polymer cable that is as strong as steel, but it has one-fifth the weight and is much more flexible.

The Vectran™ line is laced from one side of the battery mount down around a pin at the base of the sled, up around the spreader on the monitor, further up to a hook just under the tilting head, and down the other side, around the pin at the bottom of the sled, and back up to the battery where the line is tensioned and secured under a special washer.

The Vectran™ line is given its final tension by extending the telescoping posts slightly, pulling out the monitor rods as shown, and/or by tilting the sled horizontal with the monitor down and retightening the line.

The stiffening system is very useful with normal length sleds when the shot has violent moves or high stresses, such as during a vehicle shot on rough roads.

Monitors

The Clipper comes equipped with either a 7” NTSC/PAL composite monitor, or the multi-format 8.4” HD UltraBrite2™ .

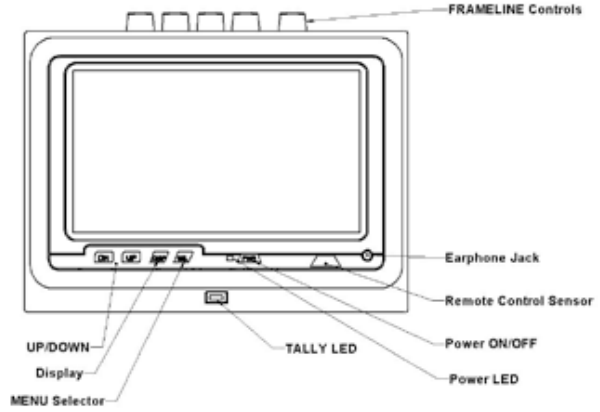
Color LCD monitor (standard) 700 nits

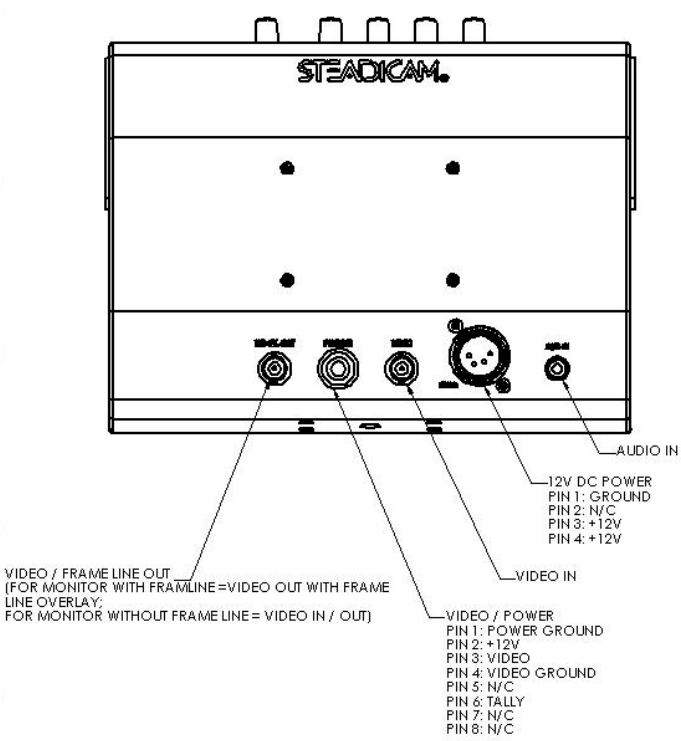
built in frame line generator

HD UltraBrite 8.4” (optional) 1400 nits

7” HD/Composite LCD

Standard 7” Monitor





■ PWR (Power ON/OFF)

Press this button to turn the monitor on/off.
When the power is on, the LED on monitor will light up.

■ SEL (Menu Selector, AV1/AV2 Selection)

1. Long press this button to switch menus. The cycle is as follows.
BRIGHT→CONTRAST→COLOR→TINT→DIMMER→ LEFT/RIGHT→UP/DOWN→SAFETY→DEFAULT
2. Short press this button to switch AV1/AV2 mode.

■ DISP (Display Mode)

Press this button to switch 4 types display mode: Full Mode, Normal Mode, Wide Mode, Zoom Mode.
Note: Under menus, press this button to turn off the OSD menu immediately.

■ NTSC/PAL Auto Selection

This monitor can detect and switch between NTSC/PAL video standards automatically.

■ SAFETY MODE

Note: The SAFETY mode in this monitor is a reserved feature and is factory set to OFF.

To Disable the SAFETY MODE use the following steps:

1.Make sure this monitor is in the □OFF□state.
2.Press and hold both□DN□and□UP□buttons at the same time, then press□PWR□button until the OSD shows the SAFETY selection menu. Release the□PWR□button, then release both the□DN□and□UP□ buttons at the same time.
3.Press□DN□button to select□OFF□mode.
4.Press again the□PWR□button to complete this setting.
After this setting is completed, even when you press DEFAULT RESET, this setting will not be reset back to〝ON〞 mode. If you want to go back to□ON□mode, you can select the menu to get□ON□mode.

IV. SPECIFICATIONS

Item	Description
Screen Size	7”(Diagonal)
Display Method	TFT Active Matrix System
Configuration	RGB vertical stripe
Resolution	1440(H) *234(V)=336960dots
Active Area	154.08(W)*86.58(H) mm
Backlight	Cold Cathode Filament Tube
Brightness	700 nits (Typ)
Audio Input Signal	2.0 Vp-p (max)
Audio Output	0.5W , 8Ω
Video Input Signal	1.0Vp-p Composite Video
Viewing Angle (Left/Right)	60 deg./60 deg.
Viewing Angle (Top)	40 deg
Viewing Angle (Bottom)	60deg
Video System	NTSC/PAL auto select
Power Consumption	10W (12V / 0.84A)
Power Requirement	DC11V~ 16V allowable
Operating Condition	Temperature□-20□~+80□ Humidity□10□~90□
Storage Condition	Temperature□-30□~+85□ Humidity□10□~90□
Overall Dimensions	180(W)*115(H)*30(D) mm

Specifications contained herein are subject to change without notice

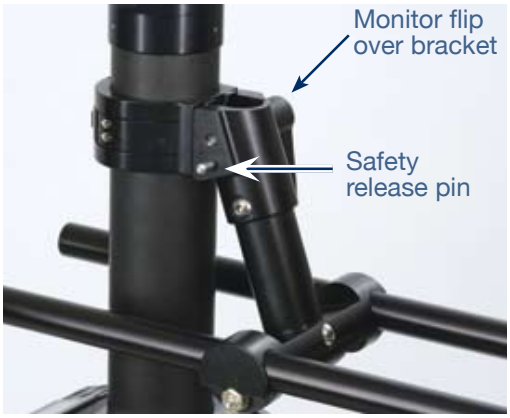
Tiffen HD UltraBrite²™ Monitor

The new HD UltraBrite²™ 8.4" TFT color monitor handles HD/SD SDI (SMPTE 259,274/292/296), DVI, Y/C, PC VGA and Composite video. With 1400 nits (cd/m2) of brightness and the use of a proprietary bonded AR glass coating, the HD UltraBrite²™ can be viewed under the most extreme lighting conditions.

4-pin XLR 12 or 24 volt input

2nd tally light input

Artificial Horizon and menu navigation controls



Tally Light

Tally LED's

Integrated into the HD UltraBrite²™ is a 8-pin Hirose connector that can be used to input 12Vdc to directly drive the front panel Tally LED's. In addition, a 800-7930 Tally Sensor can be plugged in to drive one of the Tally LED's whenever light is detected at the sensor. This can be useful for sensing the status of a tally LED on a camera and displaying the status on the front of the monitor. A LEVEL adjustment potentiometer is located on the rear of the monitor to adjust the sensitivity of the sensor if required.

The Mounting Yoke

The mounting yoke's pivots are aligned with the monitor's c.g. – so you can angle the monitor for viewing without changing static or dynamic balance.

LED Horizon Display

Integrated into the front bezel of the monitor is a unique LED based electronic horizon display. There are no user controls for this display in the monitor - it's controlled by serial data from specific Steadicam® models, like the Ultra², the Clipper 324 and the Clipper 312.

The LED horizon display is especially useful if, when working with composite video signals, the operator wants to view the image without the clutter of data on the screen. When working with HD video signals – which can't be overlaid with active OSD graphics –the LED horizon display is the only option for displaying horizon data.

Features

- Selectable Color Temperature (9300K / 8000K / 6500K / 5000K).
- Brightness/Contrast/Color/Tint/ Sharpness/Gamma Adjustable.
- Portrait/Landscape Image Rotation.
- Vertical and Horizontal Image Flip Capabilities.
- Adjustable Image Scaling, 4:3, 16:9, 2.35:1 Anamorphic, Under scan and more.
- Control settings stored in non-volatile memory.
- Automatic video format switching.
- Isolated video inputs.
- Picture-in-picture (PIP).
- Non volatile memory storage of monitor settings.
- Dimmable dual Tally light indicators for studio applications.
- Selectable OSD Menu Language Support.
- AR Glass for Direct Sunlight Viewability.
- Standard 1/4-20 and 3/8-16 tripod screw mounting holes, and optional yoke with rod mounts.
- Mounting screws located on back cover for mounting of external V-loc battery adapter.
- Front panel LED power indicator.
- Programmable Direct Access Menu Buttons.
- Fully software upgradable for special applications or future options.
- Mounting yoke.
- Instant on feature that powers up monitor without pressing additional buttons.
- Integrated 10-LED horizon display.
- Wide support of SDI, HDSDI, RGB, YPbPr, YCbCr, SVHS, Composite NTSC/PAL/SECAM, DVI-D, and RGB video formats.
- Unique dual chamber aluminum case design to help dissipate internal heat and keep electronics cool without the use of a fan.
- Ergonomic cable connection layout to help prevent cable snags.

Operating Tips

To reduce the power consumption of the monitor when in "Stand-by" mode, the screen brightness can be reduced. By turning down the brightness instead of turning off the monitor, the monitor can be quickly brought back up to with waiting for the monitor to re-initialize.

When operating in dim lighting conditions the Tally light brightness can be reduced by setting the Brightness switch to the LO position, or inversely to the HI position for brightly lit operating conditions.

For best monitor performance, set the video setting to the display format that you are currently using (Composite, HDSDI -1 etc.) and disable the video formats that you will not be using through the Auto Source Seek set-up menu.

When operating video transmitters or video converters with the monitor, power from the monitors 4-pin Hirose or 4-pin XLR power connectors can be used to power the external equipment. Take note that the maximum input current cannot exceed 4A including monitor current. Also take note that the input voltage will be the same as the output voltage. If the monitor is run from 24V, all the other power connectors will have 24V present.

If connecting a video transmitter or other external device to the HD UltraBrite^{2}™ that requires a composite video feed, make sure to remove the 75 ohm termination from the external device to avoid double terminating the video signal.

To make quick access of Aspect, PIP, or other menu selections, the front control panel buttons can be programmed as "Hot Keys" to get instant selection without wading through menus.

The best way to clean your LCD panel and remove finger prints and dirt is to use a mild dish soap and a soft damp cloth.

When operating the monitor in extremely cold conditions, it may be helpful to turn the monitor on under room temperature conditions and allow the monitor to warm up before operating it in the extreme cold.

Try to keep the monitor out of the direct sun while not in use, this will help to keep the monitor casing and internal components cooler.

When operating in damp or wet set locations, make sure to keep the monitor covered with a rain hood.

CAUTION!

Connect only **one** power source to the monitor at a time.
FAILURE TO DO SO MAY CAUSE MONITOR OR EQUIPMENT DAMAGE.

Limited Warranty

The Tiffen Company warrants each UltraBrite^{2} monitor manufactured by Tiffen to be free from defects in workmanship and materials under normal conditions of use and service for a period of one (1) year parts and (6) months labor from the date of purchase provided no modifications have been made to the product. Tiffen's obligation under this warranty is limited at its option to either repair or replace the defective product. If the product has been superceded, warranty replacement can be made with a current model of the same quality performing the equivalent function. This warranty does not cover cosmetic refurbishment on any model. This warranty does not apply to any product that is subject to misuse, abnormal service, or handling or which has been modified or changed in design or construction. LCD panel defects are warranted up to ISO 13406-2 class-2 specifications. Warranty claims must be submitted to the factory for verification or to an authorized distributor designated by the Tiffen Company. Repairs by unauthorized parties will void this warranty. ALL IMPLIED WARRANTIES ARE LIMITED TO THE TIME PERIOD SET FORTH HEREIN. The Tiffen Company shall not be liable for incidental or consequential damages. All shipments of Tiffen equipment must be insured during the warranty period.

Limitation of liability

Specifications subject to change without notice.

The manufacturer's liability for damages to customer or others resulting from the use of any product supplied hereunder shall in no event exceed the purchase price of said product.

Disclaimer

There is no implied or expressed warranty regarding this material. Specifications subject to change without notice.

UltraBrite² On Screen Display

To turn on the OSD menu:	Press the MENU button
Move to next icon:	Press the MENU button
Select options within icon menu:	Use △▽◁▷ buttons.
Increase/decrease setting:	Use ◁▷ buttons
Move selection left/right:	Use ◁▷ buttons, the selected option is in green
To confirm the selection:	Use ▷ button

Picture :

Brightness	Increase/decrease panel brightness level, total: 100 steps
Contrast	Increase/decrease panel contrast level, total: 100 steps
Saturation	Increase/decrease saturation, total: 100 steps
Hue **	Increase/decrease Hue level, total: 100 steps
Sharpness*	Increase/decrease sharpness, total: 30 steps

Move the image position:

upward downward to the left to the right

Aspect Size 4

- Fill Screen : Enable full screen expansion for lower resolution Image

- Fill to Aspect Ratio: Enable fill screen expansion for lower resolution image according to aspect ratio
- 4 : 3 : scaling format in 4:3
- 16 : 9 : scaling format in 16:9
- 16 : 10 : scaling format in 16:10
- 2.35 : 1 : scaling format in 2.35:1
- 2 : 1 : scaling format in 2:1
- 1 : 1 : Display the exact image resolution on the screen without image expansion.
- Custom Sizing* :
    - Normal Size
    - Underscan
    - Custom 4
    - H Size
    - V Size
    - H Pan
    - V Pan

Blue Only 4 ON / OFF : Turn off the “Red” & “Green” channel (i.e output all zero to Red & Green channel) [This function will display on OSD menu when JP4 – 5-6 closed]

* : DISPLAY IN VIDEO MODE ONLY
** : FUNCTION IN VIDEO NTSC / HD COMPONENT MODE ONLY
# : DISPLAY IN ARGB / DVI MODE ONLY
: FUNCTION IN ARGB MODE ONLY
: DISPLAY WHEN VIDEO ADD-ON BOARD CONNECTED

Input

Select the input video signal

- HD/SD SDI 1
- HD/SD SDI 2***
- VGA
- DVI
- HD Component
- Composite
- S-Video
- SD Component
- PIP Source 4
- OFF / HD/SD SDI 1 / HD/SD SDI 2 / VGA / DVI / HD Component / Composite / S-Video / SD Component

*** DISPLAY WHEN SETTING ON UNDER SETUP AUTO SOURCE SEEK

Utilities

Setup 4

Auto Picture Setup#: Auto adjust the image position, phase and size

Auto Color Gain##: Auto Color Calibration

Wide Screen Mode detection# 4 : Recognize the wide screen mode coming from ARGB port
- Normal
- 1280x768
- 1366x768

Manual Clock## :  Adjust the image horizontal size

Manual Phase# :  Fine tune the data sampling position (adjust image quality)

Auto Source Seek :
- Setup4 Selection for the corresponding input sources detection


HD/SD SDI 1
HD/SD SDI 2
VGA
DVI
HD Component
Composite
S-Video
SD Component

The corresponding input port name display on OSD menu will disappear once setting “OFF”.
- ON – Auto source select always enable
- OFF – Disable auto source select function

De-interlacing Mode* 4


- AFM: Auto Film Mode
- TNR: Temporal Noise Reduction
- MADI: Motion Adaptive De-interlacing
- LADI: Low Angled De-interlacing

Auto Power : OFF / ON
- ON – Enable soft power off function if absence of input signals
- OFF – Disable soft power function

Video Standard (SD)* :
- Auto / NTSC / NTSC 4.43 / PAL / PAL M / SECAM

Image Orientation :
- Normal / Horizontal flip / Vertical flip / Rotate

Gamma : 1.0 / 1.6 / 2.2

OSD 4

OSD position :
- H POS: Move the OSD menu image horizontally
- V POS: Move the OSD menu image vertically

OSD Timeout (sec) : 0 – 60 :
- Adjust the OSD menu timeout period in a step of 5 seconds (max 60 seconds)
  0 = Continuous to display OSD menu.
  60 = 60 seconds later will turn off the OSD menu.

Language : English / Chinese:
- Select OSD menu language display

Transparency : ON / OFF : Set OSD transparency

Color Temperature 4

- 5000K
- 6500K
- 8000K
- 9300K
- User setting :
  USER Red :
  USER Green :
  USER Blue :
  Default : Resume to the default values

Hot Key 4

Hot key 1 :
- Volume / Brightness / Contrast / Input / Aspect / PIP Size / PIP Swap / Image Orientation

Hot key 2 :
- Volume / Brightness / Contrast / Input / Aspect / PIP Size / PIP Swap / Image Orientation

PIP 4

PIP Size : OFF / Small / Medium / Large / PBP

4 possible input groups that can be mixed for PIP :
a) VGA/HD-component
b) DVI
c) HD-SDI
d) Composite/S-Video/SD-component
Selecting a signal source from the same group for PIP is not allowed.

Move the PIP Position :


upward


downward


to the left


to the right

PIP Swap :
- Swap between the main window and PIP window

Monochrome Mode 4

- Color
- Red Monochrome
- Green Monochrome
- Blue Monochrome

Reset to Factory Defaults

* : DISPLAY IN VIDEO MODE ONLY
\# : DISPLAY IN ARGB MODE ONLY
: DISPLAY IN ARGB / HD COMPONENT MODE ONLY

Connectors, Pin-outs and Jumpers

The following table is a listing of all back panel connectors associated with the UltraBrite2™.

Connector Type	Connector Label	Pin #	Symbol	Description/Function	Comments
BNC	G/Y			HD COMPONENT INPUT, GREEN ANALOG	
BNC	B/Pb			HD COMPONENT INPUT, BLUE ANALOG	
BNC	R/Pr			HD COMPONENT INPUT, RED ANALOG	
HIROSE HR10-7R-4S	VID/PWR	1		PWR GND	
HIROSE HR10-7R-4S	VID/PWR	2		VIDEO GND	
HIROSE HR10-7R-4S	VID/PWR	3		COMPOSITE IN	See Note 2
HIROSE HR10-7R-4S	VID/PWR	4		11-36Vdc	See Note 1
LEMO EGG.1B.308.CLL	VID/PWR	1		PWR GND	
LEMO EGG.1B.308.CLL	VID/PWR	2		11-36Vdc	See Note 1
LEMO EGG.1B.308.CLL	VID/PWR	3		COMPOSITE IN	See Note 2
LEMO EGG.1B.308.CLL	VID/PWR	4		VIDEO GND	
LEMO EGG.1B.308.CLL	VID/PWR	5		RX-data	
LEMO EGG.1B.308.CLL	VID/PWR	6		TALLY	
LEMO EGG.1B.308.CLL	VID/PWR	7		11-36Vdc	See Note 1
LEMO EGG.1B.308.CLL	VID/PWR	8		TX-data	
BNC	HD/SDI 1			HDSDI/SDI VIDEO INPUT #1	
BNC	HD/SDI 1 LOOP			HDSDI/SDI VIDEO LOOP THRU #1	
BNC	HD/SDI 2			HDSDI/SDI VIDEO INPUT #2	
BNC	HD/SDI 2 LOOP			HDSDI/SDI VIDEO LOOP THRU #2	
DVI-I	DVI-I/RGB/YPbPr	1	/RX2	TMDS Data 2-	
DVI-I	DVI-I/RGB/YPbPr	2	RX2	TMDS Data 2+	
DVI-I	DVI-I/RGB/YPbPr	3	GND	Digital Ground	
DVI-I	DVI-I/RGB/YPbPr	4	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	5	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	6	DCC_CLK	DDC Clock	
DVI-I	DVI-I/RGB/YPbPr	7	DDC_DAT	DDC Data	
DVI-I	DVI-I/RGB/YPbPr	8	VS_IN	Analog vertical Sync	
DVI-I	DVI-I/RGB/YPbPr	9	/RX1	TMDS Data 1-	
DVI-I	DVI-I/RGB/YPbPr	10	RX1	TMDS Data 1+	
DVI-I	DVI-I/RGB/YPbPr	11	GND	Digital Ground	
DVI-I	DVI-I/RGB/YPbPr	12	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	13	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	14	DDC_5V	+5V power supply for DDC (optional)	
DVI-I	DVI-I/RGB/YPbPr	15	GND	Ground (+5, Analog H/V Sync)	
DVI-I	DVI-I/RGB/YPbPr	16	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	17	/RX0	TMDS Data 0-	
DVI-I	DVI-I/RGB/YPbPr	18	RX0	TMDS Data 0+	
DVI-I	DVI-I/RGB/YPbPr	19	GND	Digital Ground	
DVI-I	DVI-I/RGB/YPbPr	20	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	21	NC	No connection	
DVI-I	DVI-I/RGB/YPbPr	22	GND	Digital Ground	
DVI-I	DVI-I/RGB/YPbPr	23	RXC	TMDS Clock+	
DVI-I	DVI-I/RGB/YPbPr	24	/RXC	TMDS Clock-	
DVI-I	DVI-I/RGB/YPbPr	C1	R	Red or Pr	
DVI-I	DVI-I/RGB/YPbPr	C2	G	Green or Y	
DVI-I	DVI-I/RGB/YPbPr	C3	B	Blue or Pb	
DVI-I	DVI-I/RGB/YPbPr	C4	HS_IN	Analog horizontal sync	
DVI-I	DVI-I/RGB/YPbPr	C5	GND	Ground	
DVI-I	DVI-I/RGB/YPbPr	C6	NC	No connection	

Connector Type	Connector Label	Pin #	Symbol	Description/Function	Comments
HDB-15	VGA/RGB	1	PCR	Red, analog	
HDB-15	VGA/RGB	2	PCG	Green, analog	
HDB-15	VGA/RGB	3	PCB	Blue analog	
HDB-15	VGA/RGB	4	ID2	Reserved for monitor ID bit 2 (grounded)	
HDB-15	VGA/RGB	5	DGND	Digital ground	
HDB-15	VGA/RGB	6	AGND	Analog ground red	
HDB-15	VGA/RGB	7	AGND	Analog ground green	
HDB-15	VGA/RGB	8	AGND	Analog ground blue	
HDB-15	VGA/RGB	9	DDC_5V	+5V power supply for DDC (optional)	
HDB-15	VGA/RGB	10	DGND	Digital ground	
HDB-15	VGA/RGB	11	ID0	Reserved for monitor ID bit 0 (grounded)	
HDB-15	VGA/RGB	12	DDC_SDA	DDC serial data	
HDB-15	VGA/RGB	13	HS_IN	Horizontal sync or composite sync, input	
HDB-15	VGA/RGB	14	VS_IN	Vertical sync, input	
HDB-15	VGA/RGB	15	DDC_SCL	DDC serial clock	
4-PIN Mini DIN	SVHS	1	GND	Ground (Y) Luminance	
4-PIN Mini DIN	SVHS	2	GND	Ground (C) Chrominance	
4-PIN Mini DIN	SVHS	3	Y	Intensity (Luminance)	
4-PIN Mini DIN	SVHS	4	C	Colour (Chrominance)	
BNC	VIDEO			COMPOSITE IN	See Note 3
HR212-10R-8SD(73)	TALLY	1		PWR GND	
HR212-10R-8SD(73)	TALLY	2		REGULATED +12V	
HR212-10R-8SD(73)	TALLY	3		N/C	
HR212-10R-8SD(73)	TALLY	4		TALLY 1 IN	APPLY 12V FOR OPERATION
HR212-10R-8SD(73)	TALLY	5		N/C	
HR212-10R-8SD(73)	TALLY	6		TALLY 2 IN	APPLY 12V FOR OPERATION
HR212-10R-8SD(73)	TALLY	7		TALLY 1 SENSOR IN	
HR212-10R-8SD(73)	TALLY	8		N/C	
4-PIN XLR	11-36Vdc	1		PWR GND	
4-PIN XLR	11-36Vdc	2		N/C	
4-PIN XLR	11-36Vdc	3		11-36Vdc	See Note 1
4-PIN XLR	11-36Vdc	4		11-36Vdc	See Note 1

*****CAUTION***** , all power sources are tied together. Apply only one power source at a time!
i.e. a 12V input on one connector will result in a 12V output on all other connectors; a 24V input on one connector will result in a 24V output on all connectors.

Note 1:

Note 2: - Composite video lines from both Hirose and LEMO connectors are connected together.

- Video input into these connectors will pass through the built-in frame line generator if present.

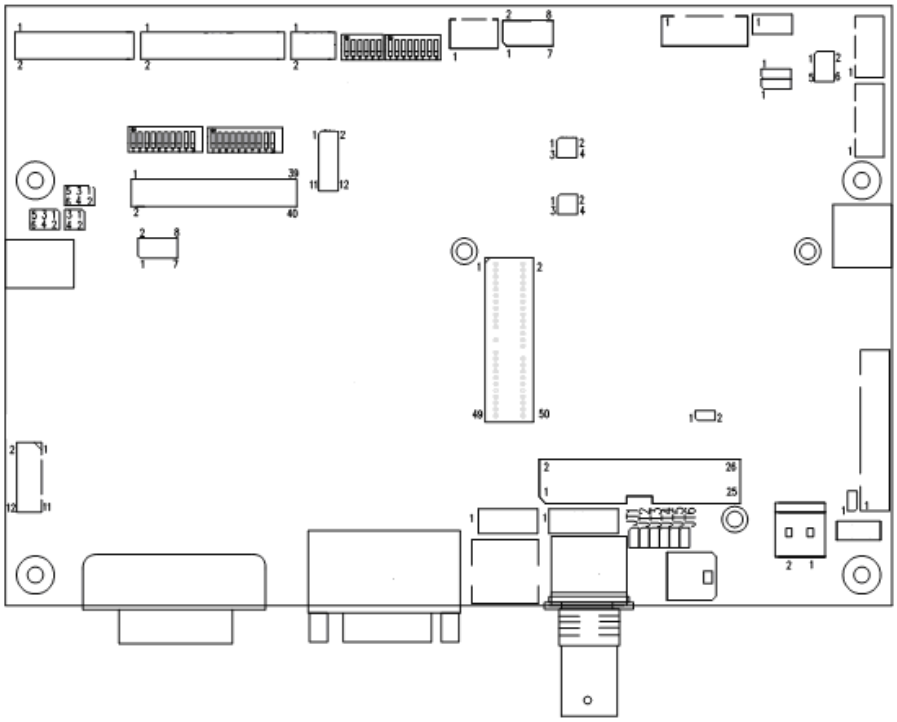
Note 3: - Composite video input into this connector will not pass through built-in frame line generators if present.


G/Y
B/Pb
R/Pr
VID/PWR
VID/PWR
HD/SDI 1
DVI-I/RGB/YPb
VGA/RGB
SVHS
VIDEO
HD/SDI 2


A TIME
LEVEL
TALLY
11-36Vdc

Termination Jumper Settings

The factory default setting for all 75Ω termination jumpers for Composite, S-Video and Component inputs is set to on, or terminated.



Jumper		
JT1	Composite video-in terminator enable	Open = composite video input is not terminated Close = composite video input is terminated with 75Ω. “Only applies to video signals input via the Video BNC connector or via the 4-pin Hirose and 8-pin Lemo connectors when optional frameline generator is not installed.)
JT2	S-Video luma-in terminator enable	Open = S-video luma input is not terminated Close = S-video luma input is terminated with 75Ω
JT3	S-Video chroma-in terminator enable	Open = S-video chroma input is not terminated Close = S-video chroma input is terminated with 75Ω
JT4	Component luma-in terminator enable	Open = component luma input is not terminated Close = component luma input is terminated with 75Ω
JT5	Component Cr-in terminator enable	Open = component Cr input is not terminated Close = component Cr input is terminated with 75Ω
JT6	Component Cb-in terminator enable	Open = component Cb input is not terminated Close = component Cb input is terminated with 75Ω

Specifications

Model #:	800-7500-XX
Screen Brightness:	Sunlight viewable 1400 nits with bonded AR coating
Screen Size:	8.4” TFT
Contrast Ratio:	250:1
Display Resolution:	800 (W) x 600 (H)
Power Consumption:	36W max. @ 24V (15W typ. with brightness at min.)
Operating Voltage:	11-34Vdc (reverse polarity protected)
CCFL Backlight Life:	40,000 to 45,000 hours typical
Power Connectors:	4-pin XLR
Video/Power Connectors:	4-pin Hirose 8-pin PRO® compatible Lemo
Video Connectors:	3 x 75_ BNC HD Analog Y(G)Pb(B)Pr(R) 1 x 75_ BNC Composite 1x SVHS 1x DVI-D 1x ANALOG RGB 4x 75_ BNC Looping HDSDI
Tally:	8-pin Hirose
Dimensions:	8.2”W x 7.5”H x 4”D approx
Weight:	5.0 lbs. with yoke & FLG
Supported Video Formats:	HDSDI: 720 50p, 720 59.94p, 720 60p, 1080 23.98i, 1080 24i, 1080 25i, 1080 29.97i, 1080 30i, 1080 23.98p, 1080 24p, 1080 25p, 1080 29.97p, 1080 30p Composite NTSC, PAL, SECAM VESA VGA, SVGA, XGA, SXGA, UXGA DVI input support up to 1920x1200 60Hz input signals.
Storage temperature limits:	-40°C to +70°C
Operating temperature limits:	0°C to +50°C
Environmental	RoHs Compliant

Accessories

- 252-7565 Monitor Hood
- 800-7930 Tally Sensor
- FGS-900093 Rain/Dust Cover

REVISIONS				
BY	REV.	DESCRIPTION	DATE	APPROVED
R. ORF	A	PRODUCTION RELEASE	05-09-08	

CLIPPER 312/324 CONNECTOR DESCRIPTION

Connector Label	Connector Type	Pin #	Description/Function	Comments
PWR	LEMO ECG.0B.303	1	PWR GND	See Note 4
PWR	LEMO ECG.0B.303	2	+12V BATTERY	See Note 1
PWR	LEMO ECG.0B.303	3	+24V BATTERY	See Note 2
HD	BNC MALE	n/a	HDSDI VIDEO	Direct coax connection to HDSI BNC on stage rear. Isolated Video gnd. Use for RGB "G".
PWR/VID	HIROSE HR10-7R-4S	1	PWR GND	See Note 4
PWR/VID	HIROSE HR10-7R-4S	2	VIDEO GND	See Note 4
PWR/VID	HIROSE HR10-7R-4S	3	VIDEO	See Note 3
PWR/VID	HIROSE HR10-7R-4S	4	+12V BATTERY	See Note 1
VID IN/OUT	RCA	N/A	VIDEO IN or OUT	Video Input or Output function selected by IN/OUT selector switch. See Note 3.
MON	LEMO EYG.1B.308	1	PWR GND	See Note 4
MON	LEMO EYG.1B.308	2	+12V BATTERY	See Note 1
MON	LEMO EYG.1B.308	3	VIDEO	See Note 3
MON	LEMO EYG.1B.308	4	VIDEO GND	See Note 4
MON	LEMO EYG.1B.308	5	RX-data	
MON	LEMO EYG.1B.308	6	TALLY	
MON	LEMO EYG.1B.308	7	+24V BATTERY	See Note 2
MON	LEMO EYG.1B.308	8	TX-data	
RGB "B"	SMB	N/A	BLUE RGB Video	Direct coax connection to "B" SMB connector below stage.
RGB "R"	SMB	N/A	RED RGB Video	Direct coax connection to "R" SMB connector below stage.

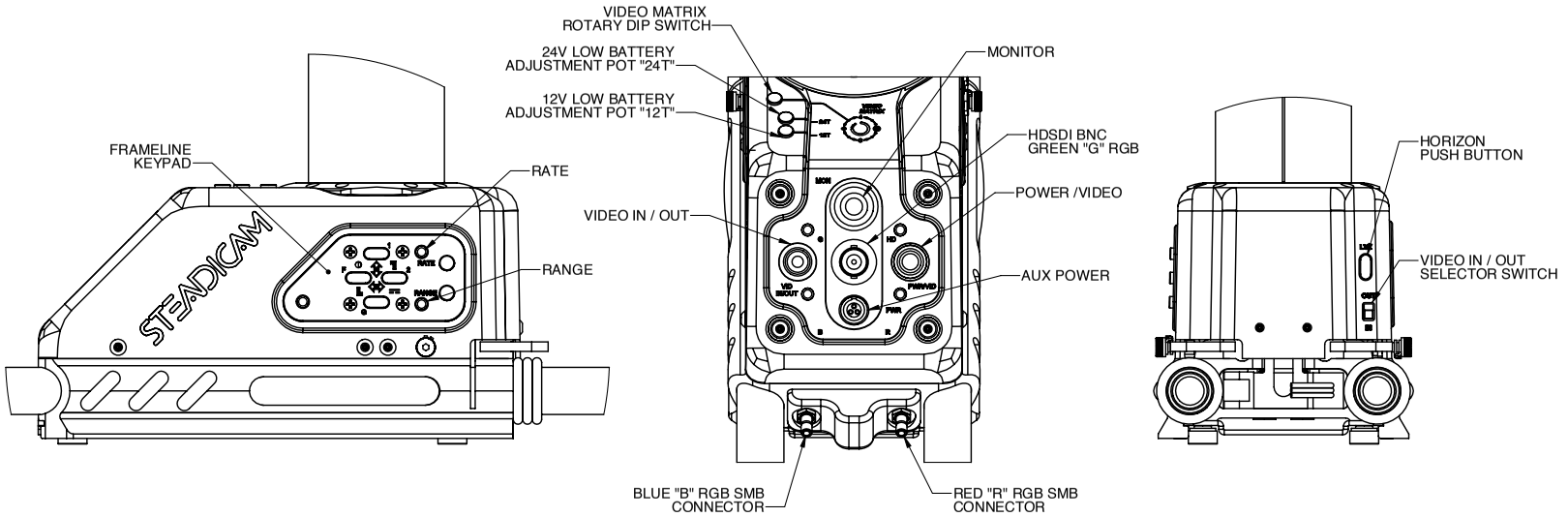
Note 1:	- 12V BATTERY VOLTAGE is sourced directly from battery voltage on 312 and in 12V mode on 324. (Typically 11-17V).
	- 12V BATTERY VOLTAGE is sourced directly from DC-DC converter in 24V mode on 324. (14.4 to 14.6Vdc at 100W max.)
Note 2:	- 24V BATTERY VOLTAGE is sourced directly from two sled batteries connected in series on 324. (Typically 22-34V)
Note 3:	- Video source is determined by Video Matrix rotary DIP switch.
Note 4:	- POWER GND and VIDEO GND can be connected by internally jumpering JP2-1 to JP2-2 on 800-0005 board.

RATE CHOICES	
Setting	+/- Degrees
0 (Default)	5
1	2
2	2.5
3	3
4	3.5
5	4
6	4.5
7	5
8	5.5
9	6
A (10)	6.5
B (11)	7
C (12)	8
D (13)	9
E (14)	10
F (15)	180

RANGE CHOICES	
Low Pass filter settings (6-Pole IIR filter)	
Setting	Hz
0 (Default)	5
1	0.75
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8
A (10)	10
B (11)	12
C (12)	13
D (13)	16
E (14)	18
F (15)	40

	Selector Switch Position Clipper 312/324															
Connector	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
VID IN/OUT* (Front Panel)																
Post Video Input	X		X		X		X		X		X		X		X	
Post Video Input with FLG Overlay		X		X		X		X		X		X		X		X
VID OUT/12V (Stage)																
Post Video Input	X	X			X	X			X	X			X	X		
Post Video Input with FLG Overlay			X	X			X	X			X	X			X	X
VID/PWR (Front panel)																
Post Video Input	X	X	X	X					X	X	X	X				
Post Video Input with FLG Overlay					X	X	X	X					X	X	X	X
MON* (Front Panel)																
Post Video Input	X	X	X	X	X	X	X	X								
Post Video Input with FLG Overlay									X	X	X	X	X	X	X	X
RCA Video Input																
MON` (Front Panel)																
Post Video Input																
Post Video Input with FLG Overlay																
RCA Video Input	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NOTE:
* = IN/OUT switch set to "OUT" position.
` = IN/OUT switch set to "IN" position.
- Position #8 is the default position.



NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES AND APPLY AFTER PROCESS FINISH.
TOLERANCING:
FRACTIONAL ±1/64
ANGULAR: MACH ±1° BEND ±1°
TWO PLACE DECIMAL ±.01
THREE PLACE DECIMAL ±.005
CONCENTRICITY: .003 T.I.R.
BREAK SHARP EDGES: .005 - .010
MACHINED FILLETS: .003 - .005 R.
MACHINE FINISH 63 RMS

NEXT ASSY | USED ON
APPLICATION
INTERPRET DRAWING PER: ANSI Y14.5M 1982
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	-	-
CHECKED	-	-
ENGINEER	rorf	5/9/2008
MFG APPR.	-	-
Q.A.	-	-

COMMENTS:

FILE NAME: 257-0000-XX

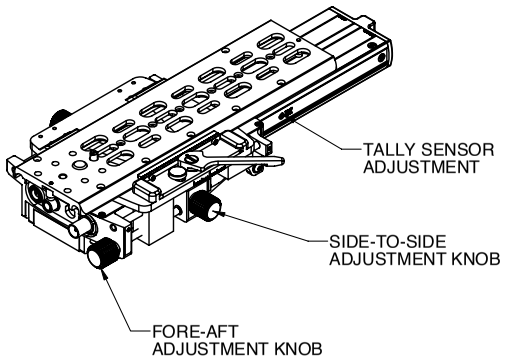
TIFFEN®
6930 San Fernando Rd. Glendale, CA 91201
Phone: 818/845-6000 Fax: 818/845-1929

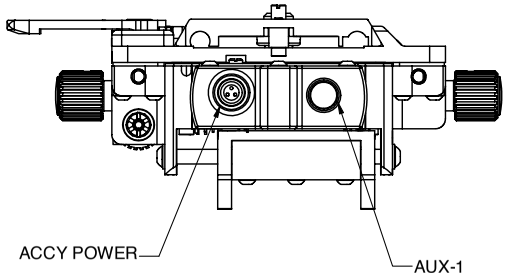
TITLE: CLIPPER 312/324 CONN. PIN-OUT DIAGRAM

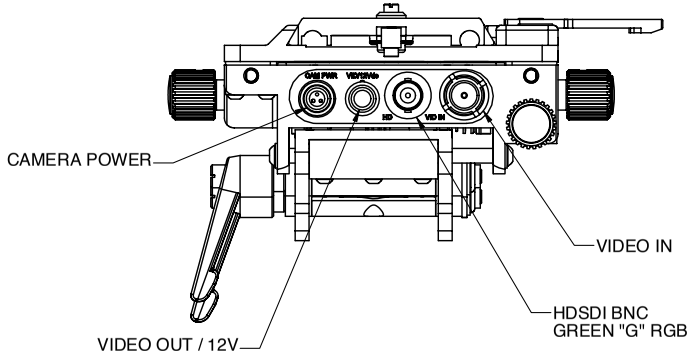
SIZE	DWG. NO.	REV
C	DOC-257000	A

SCALE: 1:4 | WT: 9.328 | SHEET 1 OF 1

REVISIONS					
BY	REV.	ZONE	DESCRIPTION	DATE	APPROVED
MW	A		PRODUCTION RELEASE	03/08/07	
RO	B		REVISED	5/9/2008	







U2 SLED CONNECTOR DESCRIPTION				
Connector Label	**Connector Type**	**Pin #**	**Description/Function**	**Comments**
VID/12Vdc	HIROSE HR10-7R-4S	1	PWR GND	See Note 4
VID/12Vdc	HIROSE HR10-7R-4S	2	VIDEO GND	See Note 4
VID/12Vdc	HIROSE HR10-7R-4S	3	VIDEO OUT	See Note 3
VID/12Vdc	HIROSE HR10-7R-4S	4	+12V BATTERY	See Note 1
CAM PWR	LEMO ECG.0B.303	1	PWR GND	See Note 4
CAM PWR	LEMO ECG.0B.303	2	+12V BATTERY	See Note 1
CAM PWR	LEMO ECG.0B.303	3	+24V BATTERY	See Note 2
HD	BNC MALE	N/A	HDSDI VIDEO	Direct coax connection to HDSI BNC on sled connector panel. Isolated Video gnd.
VID IN	BNC MALE	N/A	COMPOSITE VIDEO IN	
12/24Vdc	LEMO EPG.0B.303	1	PWR GND	See Note 4
12/24Vdc	LEMO EPG.0B.303	2	+12V BATTERY	See Note 1
12/24Vdc	LEMO EPG.0B.303	3	+24V BATTERY	See Note 2
AUX-1	HIROSE HR212-10RA-8SDL	1	PWR GND	See Note 4
AUX-1	HIROSE HR212-10RA-8SDL	2	RESERVED	
AUX-1	HIROSE HR212-10RA-8SDL	3	RESERVED	
AUX-1	HIROSE HR212-10RA-8SDL	4	RESERVED	
AUX-1	HIROSE HR212-10RA-8SDL	5	RESERVED	
AUX-1	HIROSE HR212-10RA-8SDL	6	RESERVED	
AUX-1	HIROSE HR212-10RA-8SDL	7	TALLY SENSE	
AUX-1	HIROSE HR212-10RA-8SDL	8	RESERVED	
Note 1:	- 12V BATTERY VOLTAGE is sourced directly from battery voltage in 12V mode. (Typically 11-17V)			
	- 12V BATTERY VOLTAGE is sourced directly from DC-DC converter in 24V mode. (14.4 to 14.6Vdc at 100W max.)			
Note 2:	- 24V BATTERY VOLTAGE is sourced directly from two sled batteries connected in series. (Typically 11-34V)			
Note 3:	- Video source is determined by Video Matrix DIP switch if present.			
Note 4:	- POWER GND and VIDEO GND can be connected by internally jumpering JP2-1 to JP2-2 on 800-0005 board.			

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES AND APPLY AFTER PROCESS FINISH.
TOLERANCES:
FRACTIONAL ±1/64
ANGULAR: MACH ±1° BEND ±1°
TWO PLACE DECIMAL ±.01
THREE PLACE DECIMAL ±.005
CONCENTRICITY: .003 T.I.R.
BREAK SHARP EDGES: .005 - .010
MACHINED FILLETS: .003 - .005 R.
INTERPRET DRAWING PER: ANSI Y14.5M 1982
DO NOT SCALE DRAWING

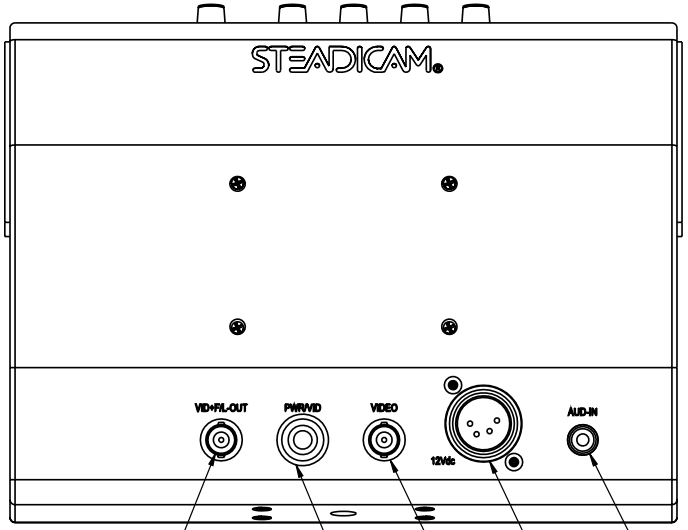
	NAME	DATE
DRAWN	MW	03/08/07
CHECKED	-	-
ENG APPR.	-	-
MFG APPR.	-	-
Q.A.	-	-

COMMENTS:
FILE NAME: 802-7400-xx
NEXT ASSY | USED ON | APPLICATION

TIFFEN®
6103 San Fernando Rd. Glendale, CA 91201
Phone: 818-843-4000 Fax: 818-845-1929

TITLE: CONNECTOR LAYOUT MEDIUM STAGE
SIZE C | DWG. NO. DOC-802740 | REV B
SCALE: 1:1 | WT: | SHEET 1 OF 1

REVISIONS					
BY	REV.	ZONE	DESCRIPTION	DATE	APPROVED
	A		PRODUCTION RELEASE	03/08/07	



VIDEO / FRAME LINE OUT
(FOR MONITOR WITH FRAMLINE =VIDEO OUT WITH FRAME LINE OVERLAY;
FOR MONITOR WITHOUT FRAME LINE = VIDEO IN / OUT)

VIDEO / POWER
PIN 1: POWER GROUND
PIN 2: +12V
PIN 3: VIDEO
PIN 4: VIDEO GROUND
PIN 5: N/C
PIN 6: TALLY
PIN 7: N/C
PIN 8: N/C

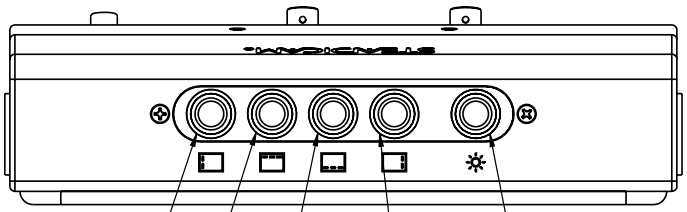
VIDEO IN

12V DC POWER
PIN 1: GROUND
PIN 2: N/C
PIN 3: +12V
PIN 4: +12V

AUDIO IN

MONITOR CONNECTORS LAYOUT

NOTES: UNLESS OTHERWISE SPECIFIED



LEFT SIDE FRAME LINE POSITION ADJUSTMENT

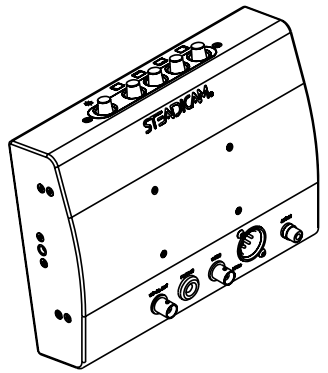
TOP FRAME LINE POSITION ADJUSTMENT

BOTTOM FRAME LINE POSITION ADJUSTMENT

RIGHT SIDE FRAME LINE POSITION ADJUSTMENT

MONITOR FRAME LINE BRIGHTNESS ADJUSTMENT

FRAMELINE GENERATOR CONTROLS



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES AND APPLY AFTER PROCESS FINISH.
TOLERANCES:
FRACTIONAL ±1/64
ANGULAR: MACH ±1° BEND ±1°
TWO PLACE DECIMAL ±.01
THREE PLACE DECIMAL ±.005
CONCENTRICITY: .003 T.I.R.
BREAK SHARP EDGES: .005 - .010
MACHINED FILLETS: .003 - .005 R.
INTERPRET DRAWING PER: ANSI Y14.5M - 1982.
DO NOT SCALE DRAWING

NEXT ASSY | USED ON | APPLICATION

	NAME	DATE
DRAWN	MW	03-08-07
CHECKED	-	-
ENG APPR.	-	-
MFG APPR.	-	-
Q.A.	-	-

COMMENTS:

FILE NAME: 302-7500-XX

TIFFEN®
6933 San Fernando Rd. Glendale, CA 91201
Phone: 818-843-4600 Fax: 818-845-1029

TITLE: CONNECTOR LAYOUT
7" LCD MONITOR

SIZE C | DWG. NO. DOC-302750 | REV A

SCALE: 1:1 | WT: | SHEET 1 OF 1

Disclaimer: There is no implied or expressed warranty regarding this material. Specifications subject to change without notice.