TECHNODOLLY SOFTWARE USERS MANUAL

Installing Updates: Copy the update file to the root directory (not in a folder) of a USB drive that is formatted to FAT32 (most common). Rename the file to be only 'update.tgz'. Plug into the TDesk and press cancel when a pop up window appears. Go to File/Install Update and once you have confirmed and the software copied, follow the onscreen instruction to reboot the computer (not simply restart the software). Go to Help/About and check that the desired version is listed for your serial number.

Section 1: Before you get started.

We will assume that power has been run to the crane and the desk, and that the camera has been mounted and 4-way balanced (head horizontal and vertical, arm static and dynamic weights). Before attempting to start the crane, be sure that the cables from desk are plugged into the crane base, either directly or through the track's cable-chain. Most importantly, the 4 pin XLR that connects the desk's E-Stop to the crane must be connected so that the brakes do not "fire" or engage, thus preventing the crane from starting. Equally important is connecting the Rocker to the base for the same reason. Please check all four E-Stops before attempting to start the crane: one at the end of the arm, another at the fulcrum, one on the Rocker and one at the desk. Twist to release the E-Stops.

Be sure to plug all cables into the appropriate connections on the back of the desk. Also, if you plan to use the remote focus/zoom handle, plug it in.

While it is not necessary to have the Desk computer on to turn on the crane it is recommended. Start with the UPS, then turn on the desk by the large red button on the back. Turn on the monitors. A normal boot up will take you to the Log-in screen. Use the "technodolly" username and type in the password, technodolly. After a few seconds the main TDesk software window should appear. In the bottom left corner of the screen the status indicator should say 'OK'. If not, check troubleshooting.

Turn on the three main power toggle switches at the column starting at the top and working down. Sometimes we refer to these three toggle switches as "circuit breakers" as they also serve this function. Then press the large red button above the #1 Main switch (Power button). The smaller round red buttons at the top and bottom are for releasing the Emergency brakes. If all goes well the head should level and the crane responds to commands from the Rocker. The Pan and tilt axis should now be engaged.

If prompted, please follow the instructions to test the brakes. With the crane on, hit one of the E-Stops. You should hear the brakes engaging with a short "Whir" sound (referred to here on as "firing"). Release the E-Stop and clear the brakes using the small round red buttons on the column described earlier. If the brakes do not fire, please inform Technocrane immediately. If the brakes fire, but do not release when the buttons are pressed, then you can manually open the brakes using the 13mm wrench (please see hardware user's manual).

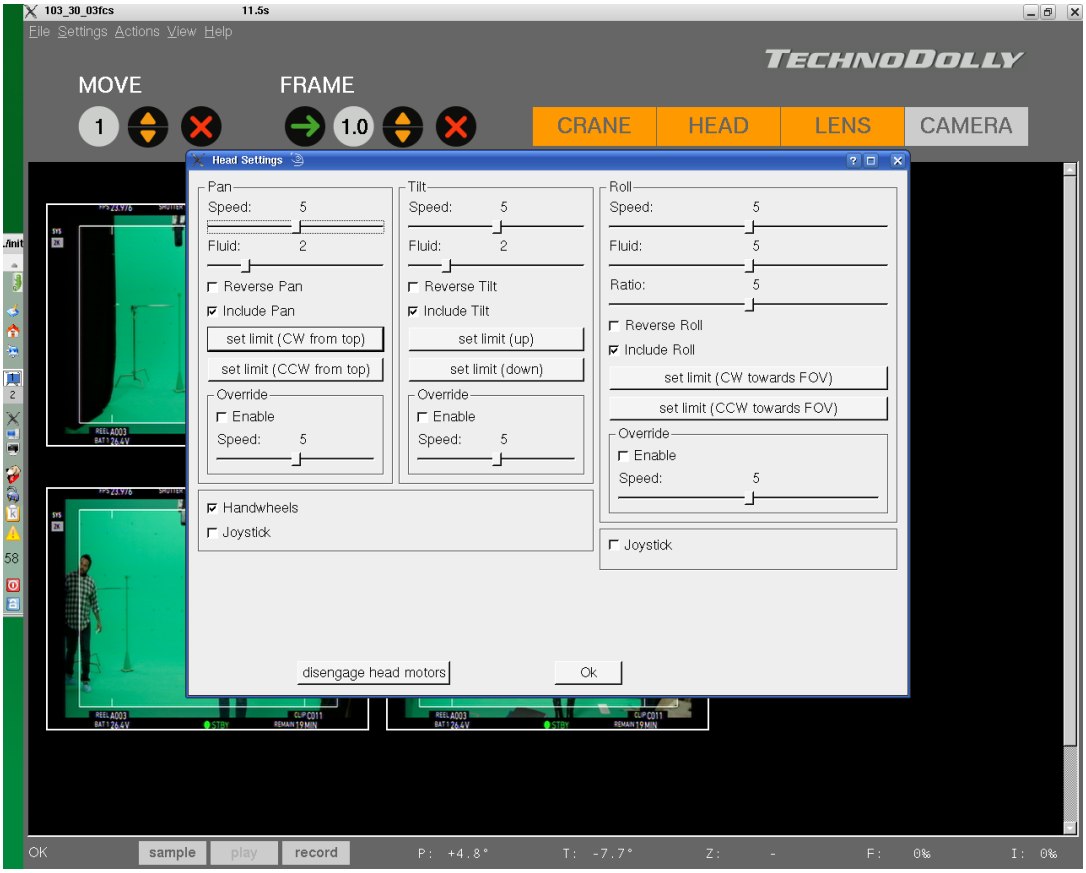
Test the head by moving either the joystick or wheels, pan and tilt should move appropriately. Also, test focus, zoom and iris controls if installed. You should see a live camera image on the right side monitor. The two monitors mounted to the crane column should have live camera and a mirror of the desk software GUI. Please refer to the wiring diagrams if necessary.

Section 2: Setting Axis Controls

As is often the case, the AC will ask if the focus can be reversed, or the DP/Operator will ask for the wheels to be faster or slower, or more fluid. Before Recording or key framing a move, set up the controls to suite the crew's needs.

RMB=Right Mouse Button LMB=Left Mouse Button or 'Click On'

Near the top of the screen are four Yellow boxes "CRANE, HEAD, LENS and CAMERA". Use the RMB to access the control panels associated with each group of axis. The LMB turns on and off these axis during playback; for example if the AC will do focus 'live' on a recorded pass, simply LMB the 'Lens' box to turn off all the lens axis. If you need to keep zoom but not focus RMB to access control panel and use the 'Include' checkbox.



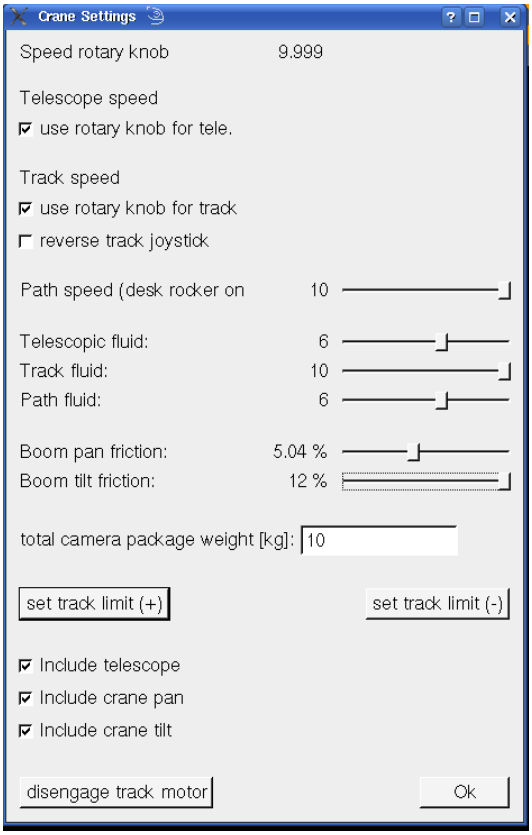
RMB the 'Head' box and you will see speed and dampening controls for Pan, Tilt and Roll. These are exactly like any other remote head controls. There is also Reverse and Include checkboxes.

There are also the Override controls. Keeping Override will allow the operator to add to the existing move in real time. Any turn of the wheels will be added to the Tilt or Pan motion throughout the move unless the wheels are returned to their starting position. You can record the changes in a repeat pass by enabling *Setting/Record Settings/Record Override.* At the end of a successful override recording a window will come up asking if you want or save or discard the changes. Be careful not to record over previous takes by reloading the original approved move.

Limits can also be set. By moving the Pan or Tilt to the desired position and hitting the appropriate Limit box you can make sure the operator does not tilt a probe into the table or knock it off with the Pan motor. Limits are also an excellent means of helping an operator whip-pan and end up perfectly composed on a pre-set hero

frame. Once a limit has been set the button switches from “Set Pan Plus Limit” to “Clear Pan Plus Limit”. **Please clear all limits at the end of a setup or shoot**. Axis that are outside their limits when the system boots up, can cause the brakes to fire (see *Troubleshooting*).

RMB the ‘CRANE’ box to see the controls for the Arm and Track axis. Also there is the ability to control the move speed when using the desk path rocker. The Boom Pan (BP) and Boom Tilt (BT) have controllable friction. The friction is electronic dampening of the Direct Drive motors that run the axis when operated manually. The default values place some friction on those axis, but the sliders allow you to set it all the way to zero percent. When using Record mode, for example, the Grip may not like the friction on the BP and BT, so you can set it to zero so it feels more like a standard Technocrane. The default values are beneficial when using key frames to build a move as the arm is more likely to stay in place when setting a position, even when properly balanced.



The “Total Camera Package Weight [kg]:” value is important for accurate data export and import because it is used in a look up table to calculate the arm deflection and the leveling heads position. It can also be used to adjust the level of the head, if needed.

You can adjust the joystick sensitivity on the rocker with the rotary knob at the end of the rocker if you select it here.

The ‘Camera’ box should be dark for most circumstances (not yellow) and RMB will allow control over video standards and camera start/stop needs. Most cameras, like the Alexa, use Momentary switches.

Take time to familiarize yourself with all of these controls. The crew counts on you to know the machine thoroughly.

Section 3: Principles and Approaches

What separates the TECHNODOLLY from traditional Technocranes is the ability to motorize every axis. While the TD works like a regular crane, it is also capable of remembering moves and key framing moves. The simplest method is to Record a move by pushing it and having the software remember or record the motion. This is appropriate when actors are doing long take performances and the camera needs to “follow along”. Once the move has been Recorded it can be played back with shutter accurate repeatability. An example would be an actor playing multiple roles in a scene, or cloning an actor.

Key framing moves allows the crane to accomplish very complex moves with perfect framing and timing. Car commercials, for example, can benefit from graceful and elegant camera moves that are perfectly composed throughout the entire move. Repeating that move opens up many creative possibilities as well. This manual will explore not only the basics of key framing, but also some advanced methods for achieving the visions of DP’s and Directors.

Section 3A: Practical Operation Principles

The TECHNODOLLY is designed for safety first and foremost. When in doubt, stop!

The TECHNODOLLY is designed to be a two person operation; the operator is at the desk who configuring the software and saving moves and the crane tech who pushes the crane and works the Rocker. The operator cannot move the crane from the desk without the crane tech holding the 'dead-man' switch halfway down (See image on page 20). If he releases or fully presses the soft yellow 'dead-man' switch, the crane will come to a gentle controlled stop. This system ensures that the crane tech pay attention to all parts of the TECHNODOLLY to make sure nothing or no one gets in its way. The operator can have control of the crane at the desk, so long as the crane tech has the 'dead-man' switch properly engaged. The same method is also required to start a move from the bloop plate and run the crane repeatably.

It is not recommended to have the operator control the rocker from the desk as his/her attention is divided and safety is compromised.

Section 4: Recording Live Moves for Data capture or Repeat Playback

We start with this method because it is the simplest way to repeat a move, as well as an effective way to capture the camera's position data. Everything is recorded, from track to focus, exactly as it happens. A few rules to follow;

Always make sure the rig and all of the axis are at a standstill when you start and end a recording.

Do not exceed the limits of the crane's motors, or it cannot be played back in real-time.

Have the bloop plate in front of the lens for the first, or hero, pass. Use the Bloop for all repeat passes

Save the Move Immediately

Press play before moving crane from the end position. If the timeline comes up, the move can be repeated in real time. If the Over Speed warning comes up you will need to try again!

On the lower left corner of the GUI are three buttons, "Sample, Play and Record". With the rig still click on the "Record" button. It will start blinking and the bloop plate will flash its green LED's. You are now recording everything the crane does. You can dolly along the track, extend and swing/tilt he arm, pan and tilt and follow with focus and zoom, it records it all. After the director or AD calls "Cut" click on the blinking 'Record' button and the recording is over. On the screen will appear two black frames indicating a successful record. Future versions will display image when Record button pressed at start and end. Please save the moves without delay. We strongly recommend coordinating with the script supervisor or camera department to make sure your move name coincides with the proper scene and take number. You will like do multiple takes before repeating one of them. You can immediately go into play by pressing the 'Play' button the desk or in the software and run the move backwards to the start. Remember that the rig is so quiet that the crew will need a warning that it is moving. You can also do a "Go To" by clicking on the first of the two black frames in the GUI window; this will "bee-line" the rig to the first position. Obviously be aware of obstacles, persons and other safety concerns. The lights at each end of the arm, as well as the Play buttons on the Rocker and Desk, will blink rapidly to indicate "Go To" mode. The speed of the "Go To" bee-line is controlled by the Path rocker. It is possible to cancel a "Go To" at any time by pressing the Play button on the Rocker or Desk. Once cancelled, the crane can be manually pushed to a desired position and the "GoTo" resumed from anywhere. When the crane has

reached the desired position (in this case, move Start) the system will automatically go into Play mode; the lights will stop blinking and the timeline will appear at the top of the GUI.

The system can stay in Play mode indefinitely until the crew is ready to shoot subsequent passes. When ready, the crane tech will hold down the 'dead-man' switch halfway and the button on the back of the bloop plate will initiate the playback of the recorded move. The playback can be stopped at any time by releasing or further depressing the 'dead-man' switch. This allows the crane tech to run backwards through the move to the start. ***The bloop plate will only start a move from the first frame of the move; or backwards, from the last frame.***

It is possible to slow down the speed of the recorded move, or even to shoot passes in stop-motion. Speeding up a recoded move is possible, but dependent upon the crane's acceleration and velocity limits.

Section 5: Key framing moves

The second method of creating moves is moving the crane to a desired position and sampling key frames. There is practically no limit to the number of key frames you can take in a move. You can start at either the beginning, middle or end of a desired path when taking key frames. Each time you sample a key frame an image from the camera appears to represent it. This helps tremendously in keeping track of which key frame is which. Key frames are called Samples on the TechnoDolly.

Let's start with a blank Move screen. You can click on the up arrow next the Move indicator near the upper left of the GUI. Move the dolly base, arm, pan, tilt focus and zoom to the desired framing. Once approved there are three ways to sample a key frame: from the desk via the large yellow button, from the GUI along the bottom of the screen or from the Rocker by simultaneously pressing the 'dead-man' switch and the Play button. (To use the Rocker key frame feature, you must first enable it in the software under *Settings/program settings/ program behavior).* Refer to image of Rocker on page 21.

A picture will appear in the move window matching the current live image from the camera. Now, lets say the director changes his mind after approving the framing. Re-frame and go up to *'Actions/Replace*. The picture will update to reflect the new position. It is possible *to* add, delete, replace or modify Samples at any time in the move editing process. When you choose Now move the crane to the next desired position. Resist the urge to over-sample the move. It is often a good idea to put in the first and last key frames first, then add the in-betweens as needed (successive refinement). At every position, simply Sample the position, a new image will appear in the Move window for every key frame. Once you have at least two Samples taken, you have a move. If you haven't moved from your most recently Sample position, you can likely go directly into Play mode by pressing Play on the Desk, in the GUI or on the Rocker. **Save moves diligently!** If the software is closed or crashes, you will have lost all work that is not saved to either the SSD or and external USB drive. See ***Section 6*** for details on saving methods.

The Play buttons will illuminate solid yellow when the system is in play. The safety lights on each end of the crane, as well as the Play button on the Rocker will be also illuminated yellow. Use the Path T/W rocker to run the crane through the move you just sampled. The system is designed to maximize the accelerations and velocity by default. In other words, the TECHNODOLLY will go as fast as it is able based on the key frames sampled. The good news is it takes the guess work out of the age old question, "How fast can it go?" Directors often know how long they want the shot to last, so the next step, even before fine-tuning the move is to set the timings to desired lengths.

On any blank or black area of the Move screen, RMB to bring up the Move Settings editor screen, or go to "*Settings/Move Settings*". This where you tell the system how fast or slow to move. You can globally adjust time by changing the values between the first move Sample and the last. It is also possible to manipulate the time between any two key frames in the move. If you exceed the crane's limits the Move Settings editor will warn you. This also where you can run the move at different frame rates. See **Section 7** for detailed explanation of the Move Setting editor's functions.

In most cases, even the simplest moves will need to be fine tuned, and at the very least focus points will need to be added. The method is the same. While in play mode, go through the move to see where you may need to make a framing or focus adjustment. Find the position where the correction is needed most; e.g. where the subject is most mis-framed. Stay in play mode, LMB the appropriate yellow axis box to disengage it, in this case Head and Lens. Alternatively, you may enable override, then you can change the head and lens values at any time. You now have control of Pan, tilt, focus and zoom. Make whatever adjustments necessary and hit the Sample button, a new Sample image will appear and a new marker will appear under the timeline cursor. Since the system is still in play mode, you can instantly preview the changes. Continue along the move path and make the **fewest** number of corrections necessary. This where the art of it comes in, so practice and learn the relationships between acceleration and position.

Actions/Sample (Replace) writes over the key frame number listed under FRAME with the current crane, head and lens position.

Actions/Sample (Insert) adds a new key frame after the number listed under FRAME with the current crane, head and lens position. It is the same as pressing the Sample button on the desk or using the rocker to a key frame.

Section 5A: Override and Record Override

The Override (OVR) function allows control of axis even when they are playing back Sampled moves. It adds to the already programmed motions of Pan, Tilt, Roll, Focus and Zoom. Crane, Track and Telescope do not have override capabilities. It is very different than simply disengaging an axis or axis group. For example, disengaging the HEAD axis group will require the operator to back pan and tilt throughout the move, as though there was no Samples taken for them. With the axis enabled and OVR turned on, the move will follow the programmed path unless the operator adds to the move as it is being played back. If the operator does not touch the Pan and Tilt controls (or the focus puller his/hers) the move will go exactly as programmed. If the operator wants to make an adjustment during the performance he/she can make live adjustments, on top of the programmed path. Think of it as Back-pan compensation on steroids. Once you have a move sampled and fine tuned, you can turn on record override and follow the steps below.

Select Override for all the axis you wish to have control over. Turn on *Settings/Record Settings.*

Start moves with the bloop plate and make sure all axis are at a standstill at start.

Run the move all the way to the end, making adjustments in real time. A dialogue box will appear asking if you wish to keep the changes.

Answer yes and *File/Save As* the move with the take number or version.

Reload the master move and go again if needed.

To play back hero take for repeating, uncheck override on all axis and turn of record override in *Settings/Record Settings.* Treat move as you would any other repeat move by using bloop, etc.

Section 5B: Dwells

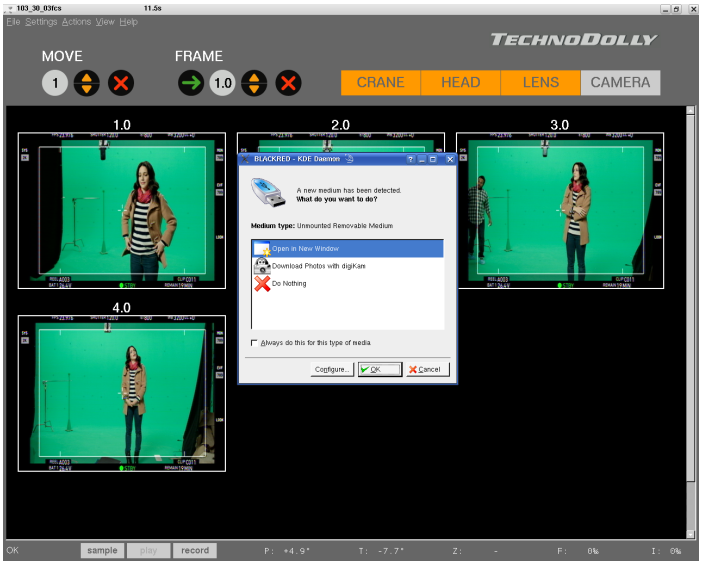
RMB any sampled image in your move and you can add a dwell time. A dwell is a specific period of time where the crane will not move. The most common application is on the first key frame to give time for the bloop to be removed before the shot starts. Conversely, a dwell can be added to the last key frame to give time to get the bloop in for a tail slate. Notice that the first and last Sample are always dwell frames. This is to bring the move to a Zero velocity, or smooth stop. A dwell can be applied to any frame and the value can be zero. However, and most importantly, making any middle key frame into a dwell changes the path to accommodate bringing the crane path to a stop. So, for example, if you have fine tuned a move with corrective Samples, those corrections will be incorrect after applying the Dwell. A dwell equivalent in Kuper is a double key frame. Be wary of dwells in Record override mode.

Section 6: Saving and Exporting Moves

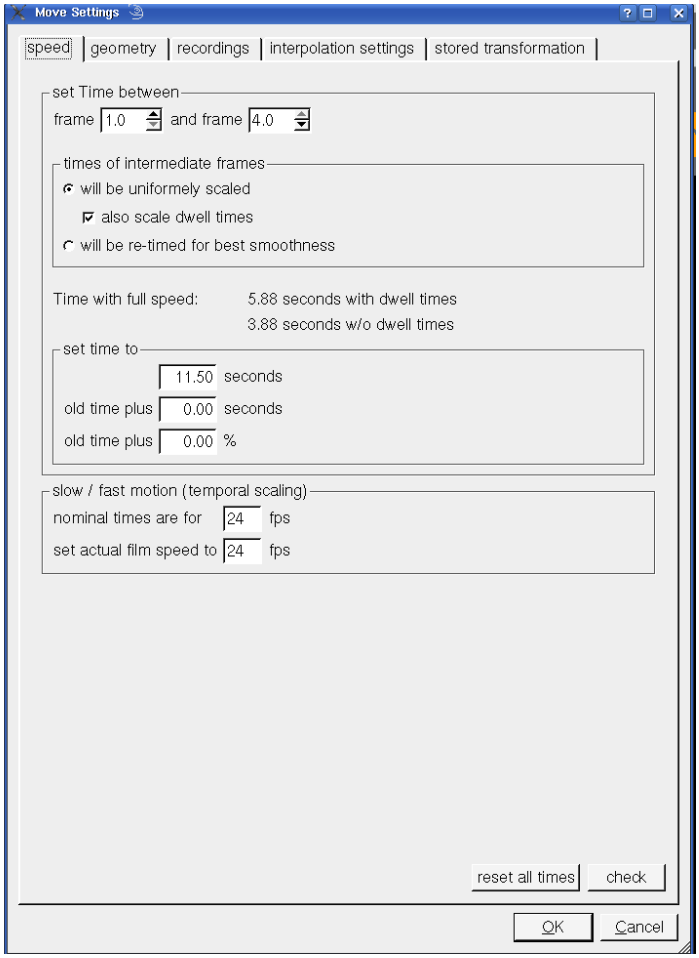
At the top left of the GUI find and click on “File”. The drop down menu exposes several options for saving and exporting moves. “Save” overwrites the move loaded, or visible in the Move screen. Be careful as you are essentially deleting the prior version, which you may wish to revert to later. “Save As” creates a new save file. “Save to USB” requires that a thumb drive or other USB memory device be plugged in.

“Load Move” is an open file dialogue box that allows saved moves to be loaded in to the Move Stack. You can have up to 99 or so moves loaded into the Move Stack. You can only save the one move visible at a time. “Save Move Collection” is a script of all the SAVED moves in the stack. It is not a substitute for Save move. It does allow you to “Load Move Collection” which makes getting up and going the next day faster and easier.

“Export CGI moves” takes the measurements entered into the “Geometry Settings” window and generates a CGI and FBX file of the move. These are frame accurate data outputs of the moves, ready to be imported into Maya or any other .fbx compatible program. The TECHNODOLLY exports all data pre-calculated into either Cartesian or Polar coordinates. The resulting fbx file converts the world space to Y up and units in centimeters.



Important Note: When a new USB device is plugged into the back of the desk, a prompt from Linux will come up. Click ‘X Cancel’ in the bottom right corner to close the window. This allows the TD GUI to access the drive. Clicking ‘OK’ makes the drive accessible to Linux, but not the TD.



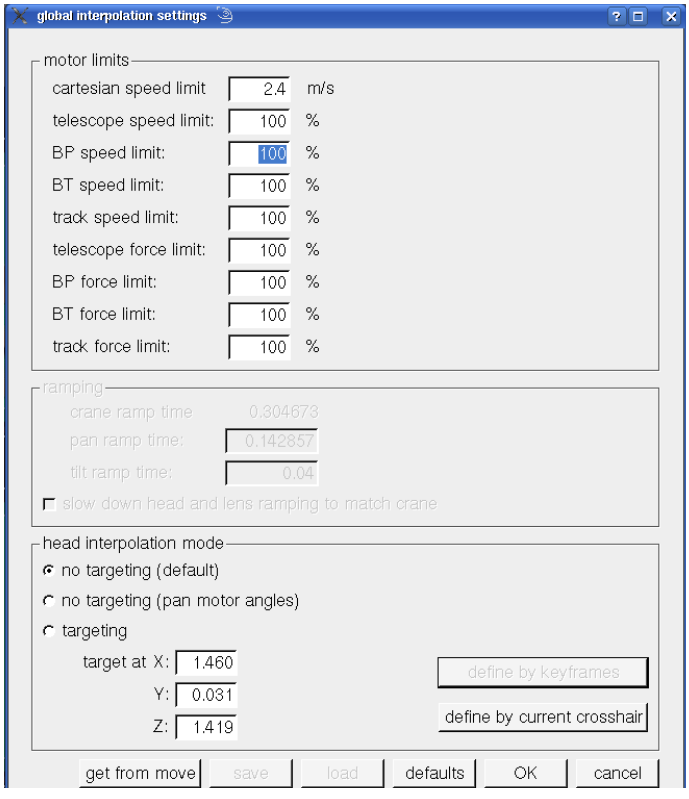
Section 7: Move Settings Editor

The Move Settings editor is the most valuable and used window in the TDesk. This is where you change the length of a move, do slow-mo and save Private Settings. It can be accessed either through Settings/Move Settings or by RMB the black areas of the screen with a move that has at least two key frames (or it isn't a move, is it).

Along the top of the window are tabs. The primary is Speed. The TD will automatically go as fast as it can on track, boom telescope and swing. Here you can slow it down to the desired speed. You can slow the entire move evenly or set specific times between any two key frames.

The Temporal scaling serves two functions. It sets the frame rate for exported fbx moves. It also is the denominator in the speed equation. If you want to run a pass a ½ the speed of the hero pass, put 12 in the lower box, in this example.

The second tab is to save Private Geometry settings. Private settings are specific to the move you are editing, and no other; whereas Global settings (accessed under Settings/Geometry Settings) affect every move that does not have private settings specified. The windows for private and global are identical, except where they are located. Private settings can only be accessed through the open move's Move Settings. Private Settings are saved with the move. An example of needing private settings is if you are pre-programming multiple shots and each shot uses a different lens, therefor different balance and unique geometry settings. There are also private Interpolation Settings. This also is helpful if you want to suppress track speed on one but not all the moves you are programming. Private interpolation settings also apply to Target mode, if each move has a unique target. If all your moves for a job have the same target and same lens/balance, then global settings will be sufficient and more time efficient.



Section 8: Interpolation Settings

Interpolation settings controls how the crane gets from key frame to key frame. The motor limits section at top allows users to suppress the crane's desire to go at maximum speed, for example. If you create a simple horizontal move that uses the arm swing, you'll notice that when the arm is shortest, the Boom Pan swings faster, creating a possibly undesirable effect in the

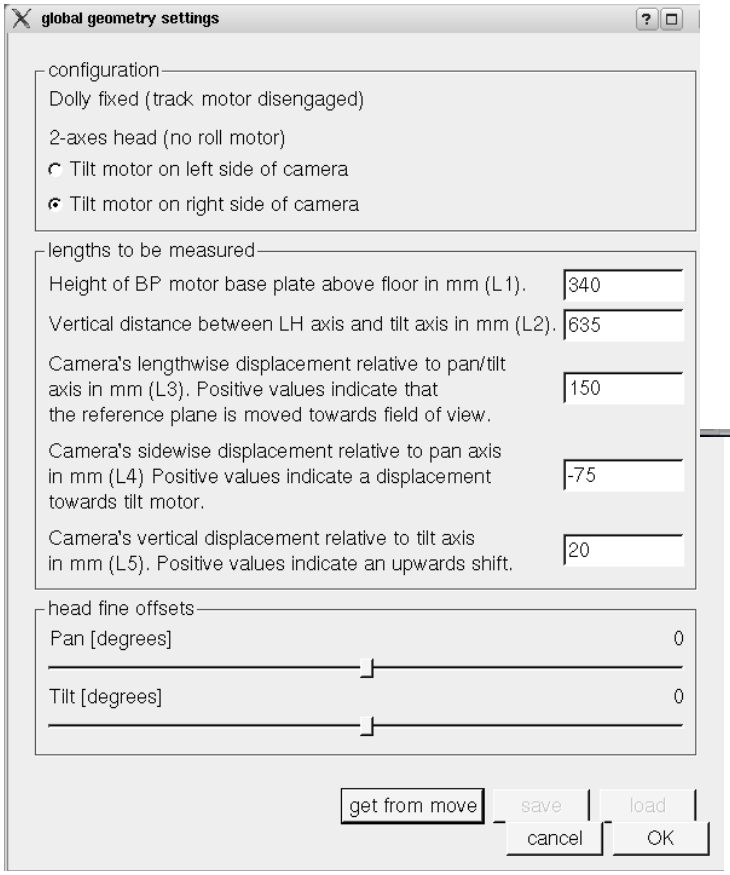
middle of a shot. This is due to the Coriolis Effect, similar to an ice skater pulling in her arms and spinning faster; because the arm is shorter, the crane can swing faster. To create an even speed on the camera, lower the *Cartesian speed limit* to something like 1 meter per second (m/s) or until you get the desired result. This is also useful for creating constant velocity, or trapezoidal, dolly moves often needed to link up moves from location to location. The default values are shown here. *Interpolation Settings* can be global as set up in *Settings/Interpolation Settings* or Private, as described in **Section 7: Move Settings.**

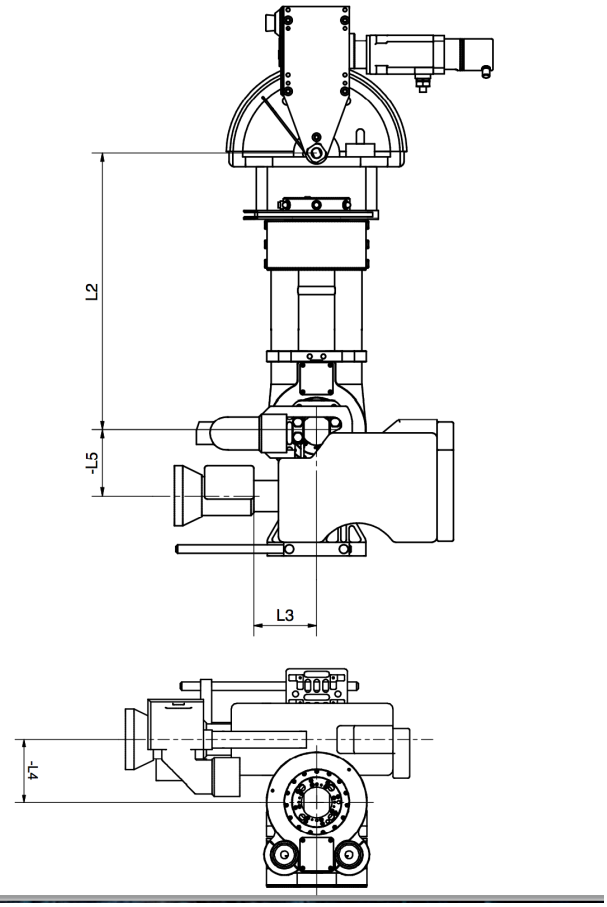
For explanation of Head Interpolation Mode, please see **Section 16: Targeting**

Section 9: Geometry Settings

Settings/Geometry Settings serves three very important purposes: exported moves are accurate, imported moves move around the lens nodal, and targeting. Geometry settings can be global, as set in *Settings/Geometry Settings* (below) or Private. See **Section 7** for Private settings.

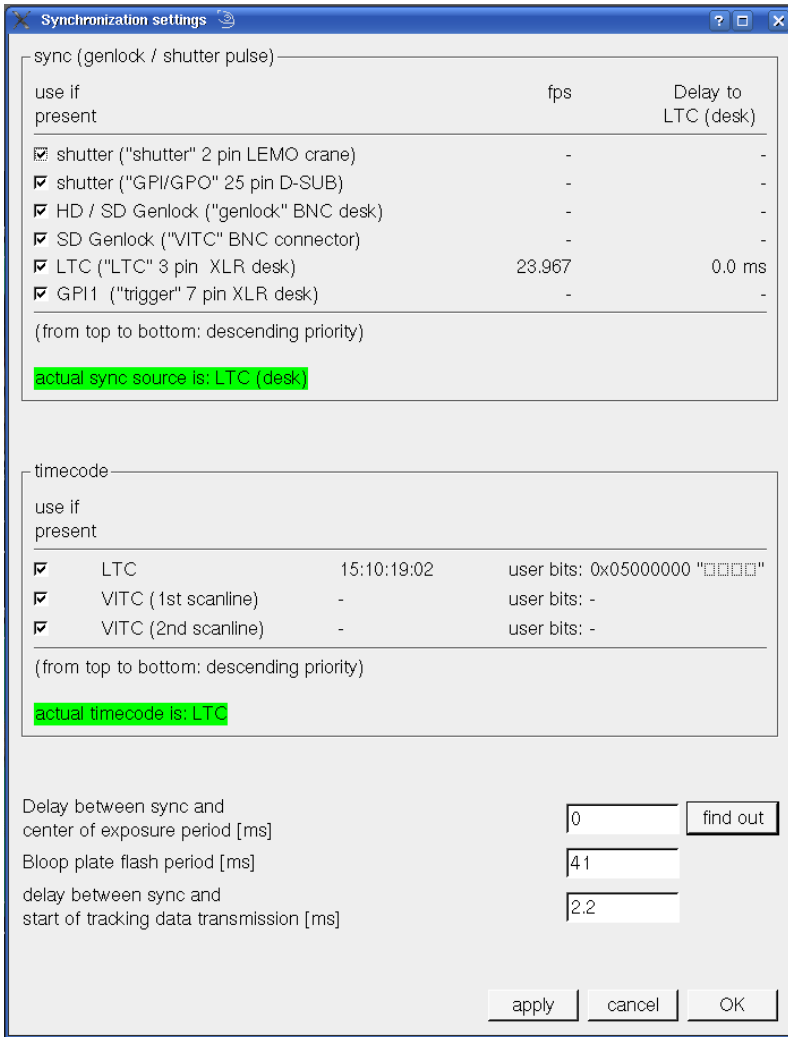
If you are using the Roll axis, the system will automatically detect it at crane initialization (power up). In most cases the Tilt motor is on the right side of camera as observed from behind the lens. If this is set incorrectly, Exported moves won't line up, fbx imports will be wrong and targeting won't work. For the lengths to be measured see the diagram at right.





Also important is that L4 is more than likely a negative number. The "get from move" button will retrieve the geometry data from an open move. It will ask the move number, referring to which move in the open moves stack. Head fine offsets can be used if Tilt, for example is not reading zero when a level indicates it is level.

Section 10: Sync Settings and Timecode



For repeating or exporting moves camera sync is necessary for frame accurate precision. If you have a Timecode (TC) source plugged into the TDesk the exporting data will be TC stamped. Obviously the TC needs to match the camera's TC, so there needs to be a master clock on set, normally the sound recording device. The TD comes with sync cables for the Arri Alexa (any Arri with a r/s socket), RED Epic and Panavision. Reading the shutter pulse from the camera is ideal. In the example image here, the sync source is the TC. That will work so long as the camera is also using the TC as a sync source but the best scenario with Digital Cinema cameras, such as the RED and Alexa, is to read the shutter pulse from the camera directly. The Alexa cable plugs into the r/s port and on the Epic it comes out of the CTRL port (not the SYNC port). If using the RED triple BNC cable, use the Yellow connector. The Alexa only provides shutter pulse when the camera is recording. Due to the descending priority if a shutter pulse is detected it will take precedence over the TC input, for example.

The Delay between sync and center of exposure is for multi camera shoots or when matching footage shot with another camera, it is not normally required to adjust this. The "find out" button flashes the bloop plate at the frame rate specified in the Settings/Move Settings menu. Point the bloop plate into the camera lens and adjust until the lights are visible across the entire frame. This as also used to center live action frames over stop motion frames.

You can adjust the Bloop Plate flash period when going at slower frame rates so that the camera doesn't miss it between exposures. 41 ms is the 1/24 of a second. A value of 1000 would be a 1 second long bloop, 200 would be 1/5th of a second. On a calculator use this formula:

***1000/frame rate=flash period* in milliseconds**.

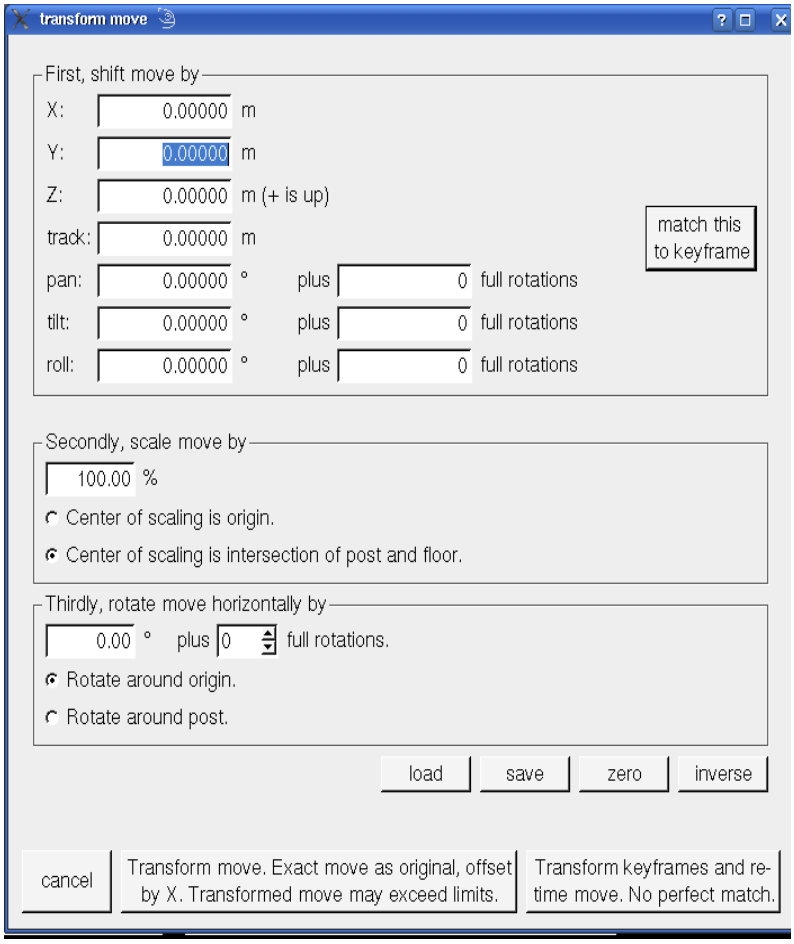
For live data exporting you can increase the delay between sync and data transmission if requested by the pre-vis techs. 2.2 ms is the minimum value.

Section 11: Stop Motion Mode

Under Settings/Playback Settings you can turn on Stop Motion mode. One in Stop Motion mode the camera will advance 1 frame every time the rocker is pushed on T and held until the yellow indicator lights flash. Once the rocker is released, you are then able to advance to the next frame. The TD does not currently support automated stop motion passes or camera triggers. Contact Anthony@supertechno.com for assistance in

determining a workflow. The Red One camera works well because you can trigger one frame at a time from the desk or focus controller.

Program or record a move normally, or import from fbx. Any move can be played back in stop motion mode. You can use the advanced Go To specific time to reach a desired frame. RMB the Frame number arrow and a dialogue box will appear asking for time to go to. Indicate seconds and decimal, not time code format.



Section 12: Transform Move

Actions/Transform Settings allows users to alter the entire move path, as opposed to an individual key frame. The window is divided into three sections and the priority or goes from top to bottom. *First, shift move by* allows users to offset the entire move in Cartesian space, or offset pan, tilt or roll in degrees. See **Appendix A** for the TD coordinate system.

X: shifts the move along the axis parallel to track. To shift a move along track, however, you need to put values in both the X and track boxes.

Y: Shifts a move perpendicular to the track axis.

Z: Shifts the move up and down.

Track: Shifts the base position but not the camera position. Enter equal values in both X and track to shift the whole move along the track.

Pan, tilt and Roll shifts those axis. You can fix issues with multiples derived from fbx import or moves from other cranes by entering integers into the *full rotations* boxes.

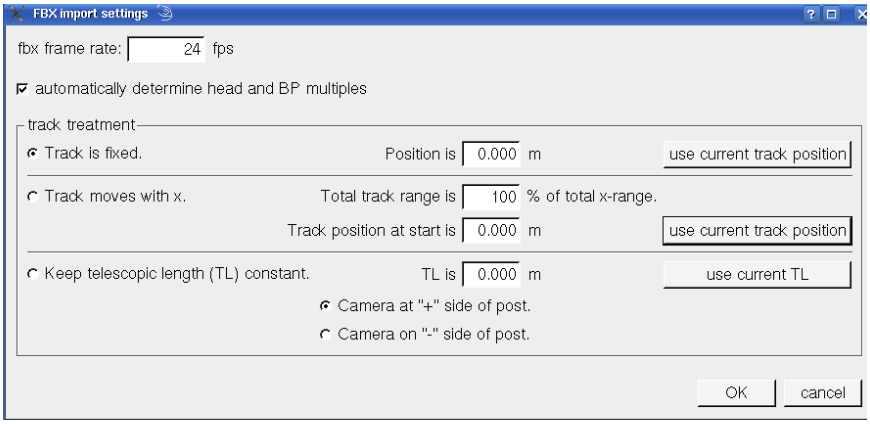
Next is Scaling. 50% scaling moves the camera half as much, and 200% twice as much. You can choose to scale from the origin, meaning where the dolly is a zero along the track. Or you can scale from the base position in the move. Expect to use subsequent shift transforming, described above, to find the proper place to run the scaled move.

Thirdly, rotate move horizontally by is to run the move rotated from it's current path. For example, if you run the A pass off one side of the track and wish to shoot the B pass off the opposite side, rotate by 180 degrees around the post.

You can Save and later reload settings later. Once you've done a transform and you reopen the window, notice the values are still there from the last transform. If you simply transform again, it will add to the existing transform. If you choose inverse instead, it is the same as "undoing" the previous transform. Zero is a short cut to clear all the current values.

Finally, you have two choices on how to transform a move. Transform move and Transform key frames. Transform move is for multi-pass VFX work where you need to run exactly the same move in a different place. With this choice, however you might exceed the speed or physical limits of the crane. For example, if you were already as high as the crane could go, the arm will simply top out at it's limit. The rest of the move will match, and that may be satisfactory, if you only needed a portion of the move to match. Exercise caution. The second choice is simply changing the values of all the key frames and the software will re-calculate the speed and path between.

Section 13: Importing moves from FBX files



Important fbx criteria:

Camera Rotation order **must** be ZXY

Units in Maya should be Centimeters

Maya world should be Y up. Place track along Z axis. The importer will convert the coordinates to Z up.

Camera must start and stop at rest in scene, the TD does not create ramps.

Above is the FBX Import dialogue that comes up from *Actions/Import move from fbx/cgi*. First you will be asked to choose the fbx or cgi file to import. Then the window above appears. It is very important to enter the frame rate that the scene was created in, most commonly 24 or 25 fps. If the fbx frame rate does not match the original Maya scene then the shot will be the wrong duration and will likely suffer interpolation noise, limiting both the maximum speed and quality of the smoothness. The checkbox for automatically determining the head and BP multiples should be checked if you are unsure. This prevents the Boom Pan, tilt, pan or roll from doing multiple 360 degree spins to get back to zero rotations. Ideally, the TD should have no pan, tilt, roll or BP multiples but it is often the case that the head has spun several times in transit. Because the encoders are absolute it counts every full rotation, even when powered down. See also "*File/Edit Move-File (_BAK)*" in **Section 14.**

Track Treatment deals with how to move the camera along the Z axis in Maya or the TD's X axis. Since the arm and the track can both accomplish this, this section deals with how to delegate the X travel. The first option is not to use any track at all and is the choice if the TD is not on track. If it is on track you can specify where along the track the base will be. One very important concept about importing fbx moves: the crane is very literal about the XYZ position imported. So if you specify a position along the track too far from the XY path, the arm will be unable to reach the start, or any part of the move. You can Transform the move to your desired place (see **Section 12**). "Track moves with X" allows you to split up the chore of X motion between the arm and track by percent. 100 percent means track does all the work and 0% means the arm does all the work, if it can. Obviously each move may require some trial and error testing. Again, when you specify the track position at start, it does not change the XY path, that must be done in Transform. You can also use the percentage to try and achieve higher camera speeds by splitting the work between track and arm. If you set the percentage to zero, the arm length will still change to accomplish nodal compensation. To eliminate all arm movement, use the third option, Keep TL Constant. This converts the TD into a fixed arm rig. It may be beneficial for

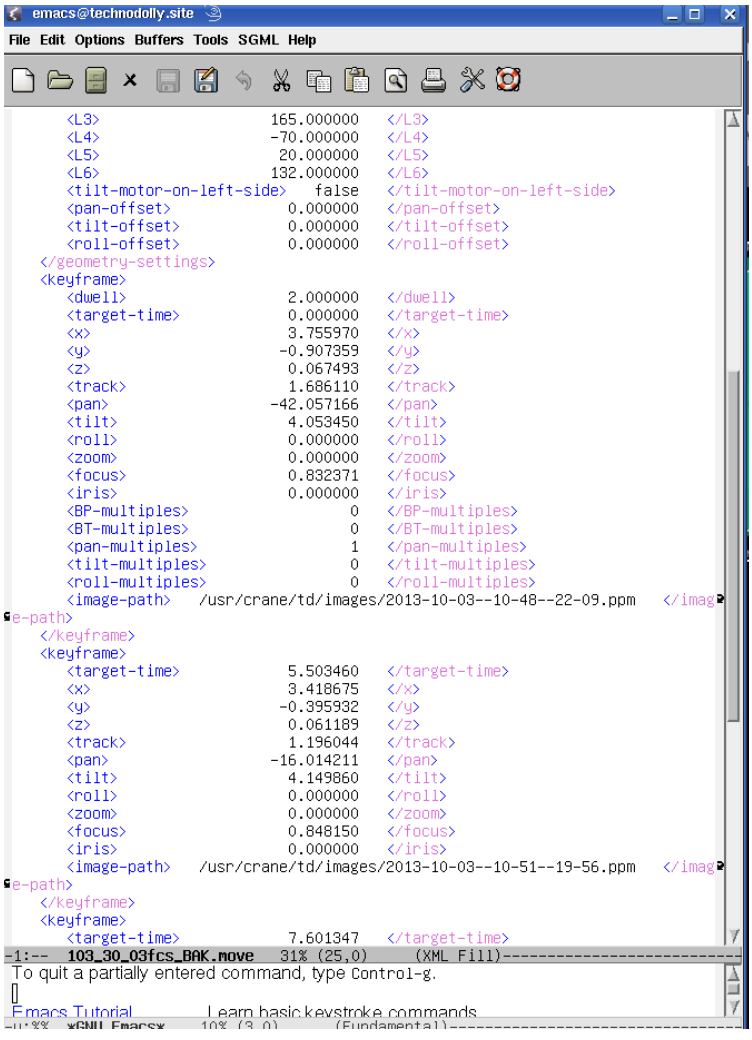
smoothness or sound. The choice for Camera on “+” or “-“ side of post tells the software which way down the track you are facing. If the camera is on the “dead end” of the cable, with the eye bolt, then that is positive. If the telescope end of the arm is over the cable drum and towards the variable end of the track, then that is negative. An imported fbx move will look exactly like a Recorded move with two black key frames. If you go into Settings/Move Settings the shot length should match the Maya scene length. If it does not then the fps was incorrect and re-import, or if the numbers are in red, then the crane cannot achieve the speed or acceleration of the imported path. Another possible cause is first or second order derivative discontinuity. Kuper operators know it as jumps in the Velocity curve. When you try to run the move a dialogue box will inform you of where and by how much the move is too fast. One thing to try is go into Settings/Interpolation settings and raise the numbers above 2.4 meters/second and more than 100%. The TD may stall but it can trick it into thinking the rig can accomplish the move, and sometimes it can. The move must be re-imported with the values higher to work. Please exercise extreme caution, and remember to reset the values to the defaults. Save the move as normal. Currently, lens information does not import, and cannot be key framed, so must be done live.

Note on Y up vs Z up: It is normal in motion picture work to have the Y axis be the vertical, or up and down axis. In engineering, however, Z is the vertical axis. The reason is simple. Movie screens are mounted vertically and graph paper rests horizontally. The TechnoDolly natively adheres to the engineering Z up world, but when creating moves in Maya, use the Y up world and the fbx importer will convert the space to Z up automatically.

Section 14: Editing moves files in text editor

It is possible to manually edit the sampled position values in the move file. If, for example you want the camera to travel perfectly parallel to the floor. Create a move by samples in the normal manner. Save the move (this is a must). Go to *File/Edit move file(_BAK).* The actual move file will open in an editor. A sample is below.

The XYZ values are in meters and the Pan tilt Roll values in degrees. Use your mouse to highlight the values you wish to change and maintain the column spacing. You can copy and paste values using the Edit pull down but normal keyboard shortcuts don’t always work. Once the values have been entered, go to *File/Save* and quit the editor. Now go to *File/Load move* and open the file with the move’s name that ends with _BAK.move. The same Sampled images should come up and you can treat it like a regular move in terms of adjusting timings and transforming, adding dwells, etc.

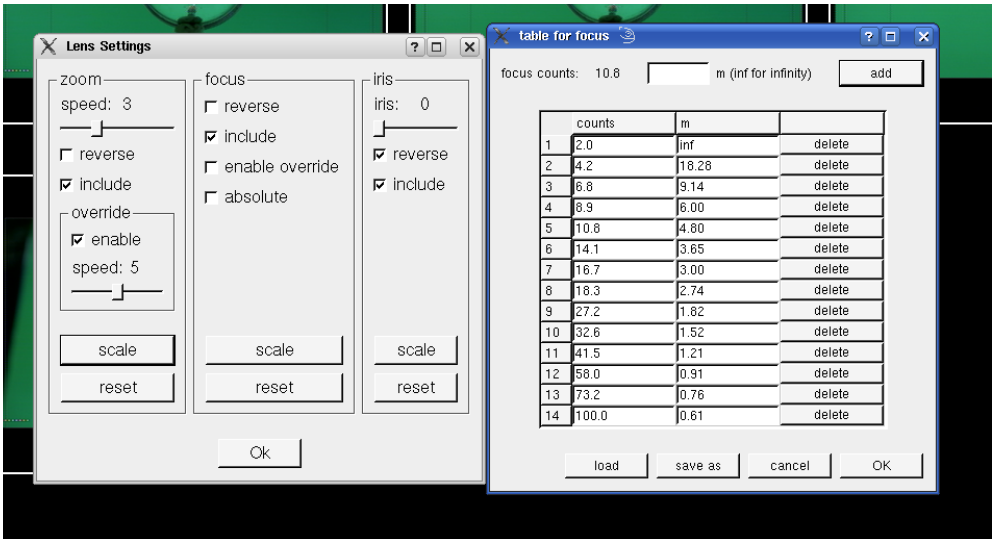


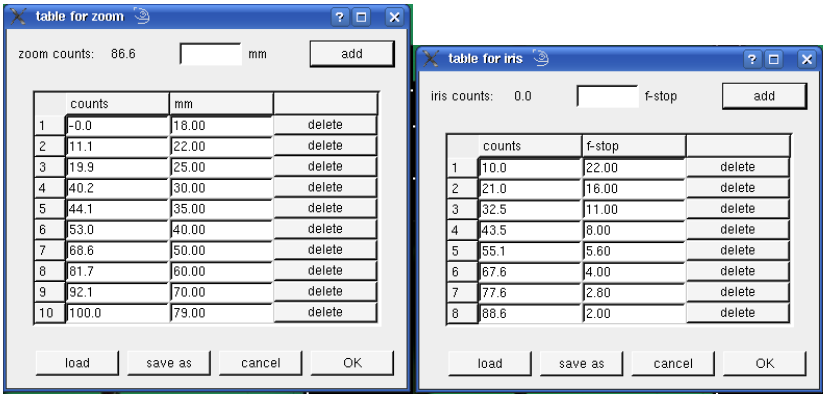
Note: in the example file here look under <Pan-multiples> 1. This means that Pan is more than 360 degrees past zero. If you were to bring this move from another crane or import from fbx the head would want to rotate 360 degrees. You can edit the multiple like any other variable to match your cranes current state. We recommend keeping the multiples at 0. If <BP-multiples> is not 0, please disconnect the cables connecting the tower to base and reset by rotating the tower and arm. If the <BP-multiple> is 1 or greater, rotate the column CCW. Check the BP multiple in the front or neutral position, as it's possible to swing into a 1 or -1 BP multiple during a move.

Section 15: Lens Scaling

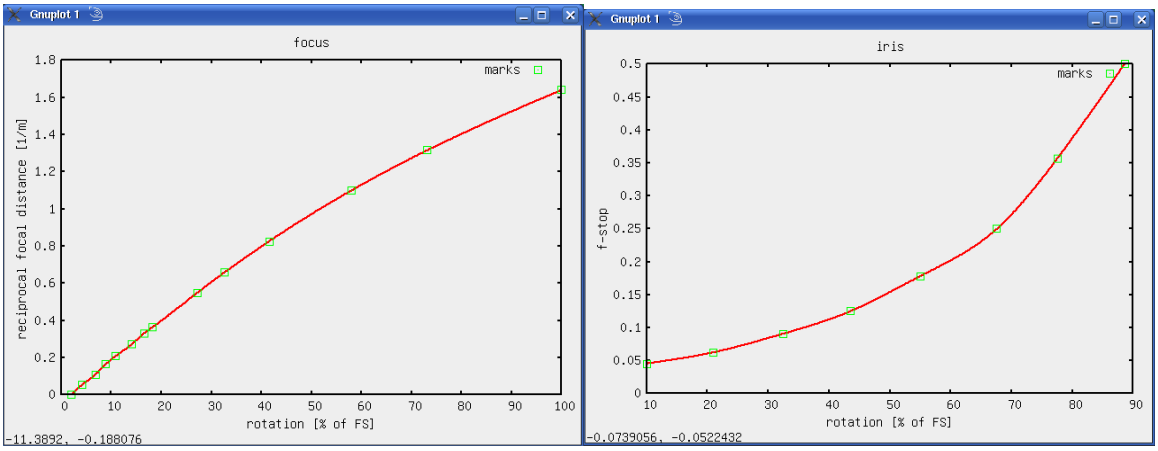
Once scaled, the values can be exported and the read from the bottom of the screen. For example, the camera is up high and the DP wants to set the zoom to 36mm and iris to an f/8, you can easily do that from the desk. Real time rendering engines, such as Motion Builder or PreVision, can use the scaled lens data.

Left Mouse Button the Yellow LENS box on the main screen. Click on "Scale" near the bottom under Zoom, Focus or Iris. Make sure the lens motor has successfully auto-homed the lens by finding the ends of the barrel movement. If you are unsure, click "reset" and be sure the lens does not skip any gear teeth. Enter "Inf" at infinity and proceed along the lens barrel markings entering values into the table. Once the value in the entry box matches the value on the lens, click ***add.*** It is best to convert imperial markings (feet) to meters; the exported data will be in the same format and if you use the focus to set Targeting (see Section 16) you will need the lens scaled in meters. Be sure to name and save the Lens Calibration file, as it can and will need to be reloaded with every software restart or lens change. When you click OK a graph will appear. It's main purpose is to show if there were any bad values entered. The graph should look like half of a parabola or so without hooks or waves. Examples below.

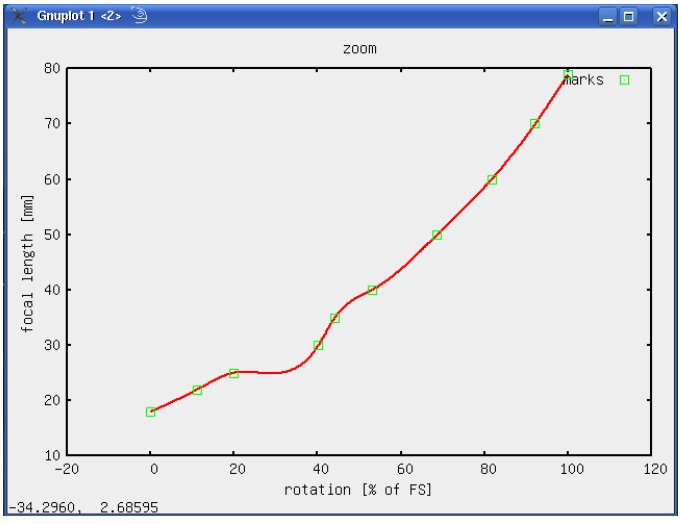




Above are examples of the focus Zoom and iris tables for a typical Zoom lens. Once you click **OK** then a graph will come up. Below are two examples of good lens graphs.



Below is what a bad graph looks like:



In this example, it looks as though the data point at 35 mm is bad. Sometimes the AC can move the lens before you can take the sample, or you can lose track and put a value in twice at the same point. You can reload the table and either fix or delete the offending point.

Converting Feet and Inches to Meters Table for TechnoDolly Lens Calibration

1 foot = .3048 meters

Feet	Meters
100	30.48
80	24.38
70	21.34
60	18.29
50	15.24
40	12.19
30	9.14
25	7.62
20	6.10
15	4.57
12	3.66
10	3.05
9	2.74
8	2.44
7	2.13
6	1.83
5	1.52
4	1.22
3	0.91
2	0.61
1	0.30

1 inch = 0.0254 meters

Inches	Meters
24	0.61
20	0.51
18	0.46
16	0.41
15	0.38
12	0.30
11	0.28
10	0.25
9	0.23
8	0.20
7	0.18
6	0.15
5	0.13
4	0.10
3	0.08
2	0.05
1	0.03

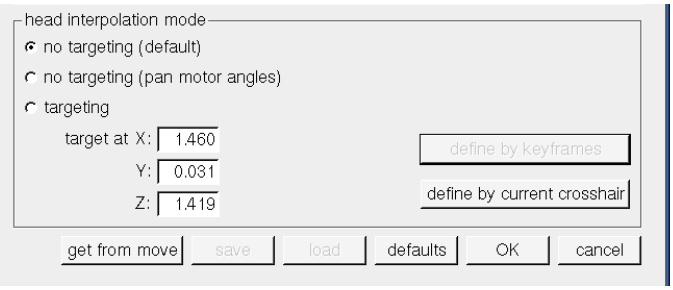
Section 16: Targeting

The following instructions were lifted from the separately distributed “Instructions for Targeting Mode”

Measure and enter the L1-L5 into ***Settings/Geometry***. Start with the Global values. Private values can only be entered after there are two or more key frames in a move. You can build the move first and enter the Geometry and Targeting values after you have taken your key frames. However, if you have time to enter all the measurements first then, once the Sample frames are taken, you can show the resulting move immediately.

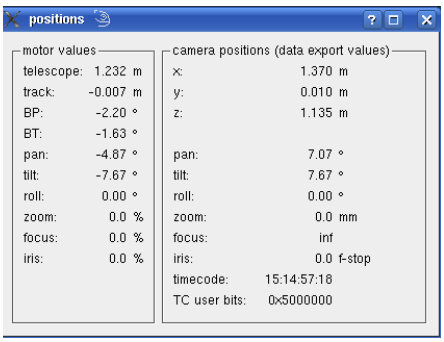
OPTIONAL: If possible, calibrate the lens focus in meters.

Move the camera reasonably close to the subject (for greater accuracy) and focus the lens. Go to ***Settings/Interpolation Settings*** and at the bottom of the dialogue box are the choices for targeting. The third checkbox should be checked for Targeting On and click the button “Set Target to Current Crosshair”. If you did not calibrate the lens focus distance, you will have the opportunity now to measure the distance manually. Measure from the object to your L3 position (normally Lens Nodal point) in meters and enter it. You will notice the values in the three XYZ boxes change. Click Save and you are now ready to build a move, or if the samples are in, see the results.



Once you have even two Samples, you can now assign Private setting to the move by going to ***Settings/Move Settings*** and bringing up the Interpolation tab seen at the top of the dialogue box. The default is to use the global settings but you can re-capture or manually enter the values again and they will be saved with that move and apply only to that move. Also note that Move Settings also now allows the saving of geometry measurements and other interpolation functions unique to every move. If you are changing lenses and re-balancing, be sure to enter the new values in the Move settings window before saving and closing the move.

View Windows: Position Window



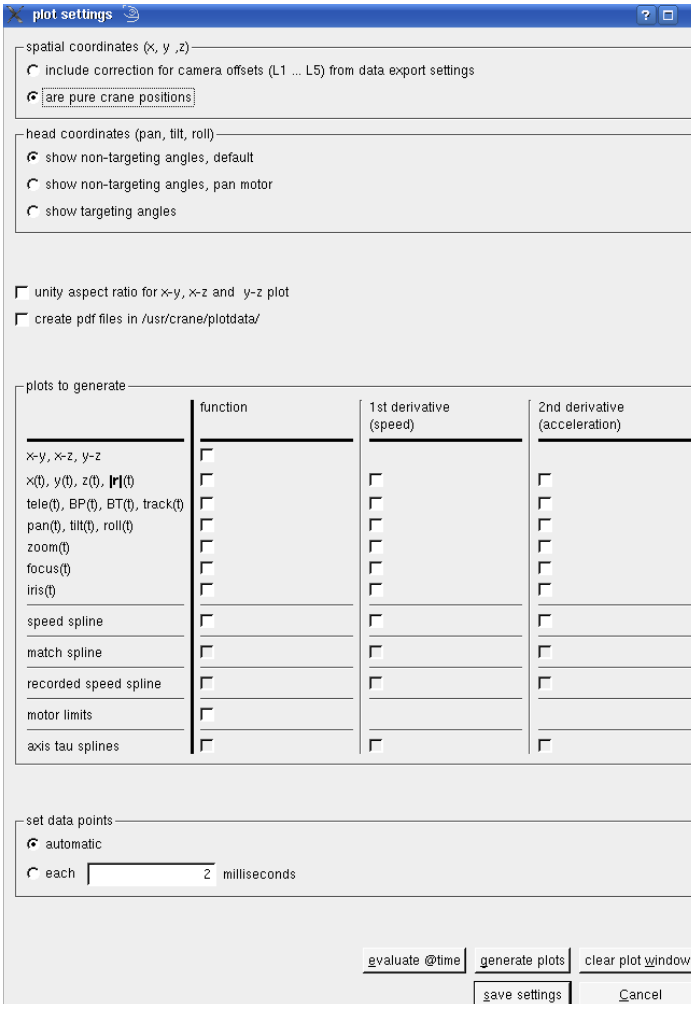
The Position window can be brought up from *View/Position Window.*

It is a great tool for knowing where the camera is. On the left side are raw axis data and the right side is Cartesian XYZ coordinates. The right side will only be accurate if the L1-L5 values have been entered. This window can be moved around to a clear spot on the GUI.

View/Curves

You can see various attributes of a move with the curve plotter. At left is the window for deciding which plots or curves to generate. You can choose to graph either raw axis positions or camera corrected Nodal position in the top box.

Next, choose to view targeting or non-targeting head coordinates. You can lock the scale of the graphs with the “unify aspect ratio” check box. And you can choose to save the graphs as pdf files.



Next comes a wide array of choices for which axis to graph. The first choice is essentially viewing the move from the top, front and side, respectively.

You can plot xyz against time (t) and view speed and acceleration curves. In Kuper, the position curve would equal the function and velocity curve would be the 1st derivative.

Motor Limit curves are useful to help determine both the kind of accelerations and which axis is limiting the top speed.

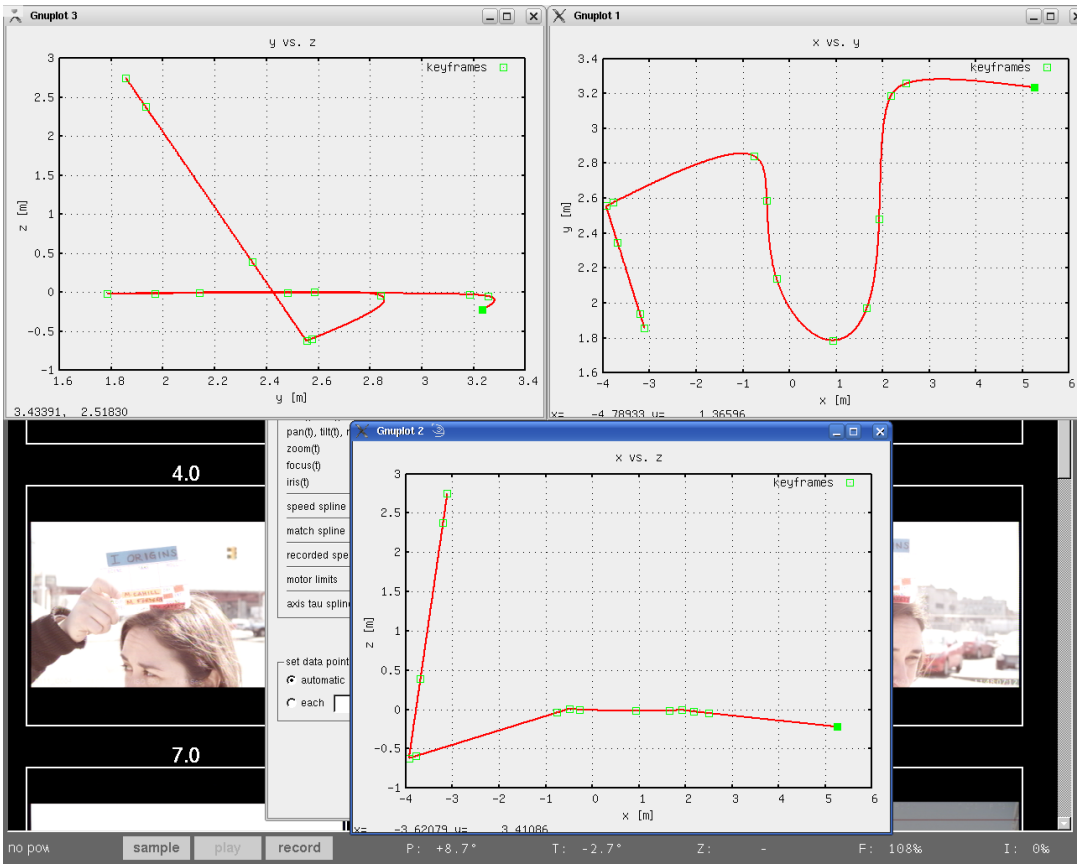
Tau is the difference between the software's calculated speed and the amount you may have slowed the path down between key frames. If you run the move at the speed the software initially calculates, the tau line will be diagonal. It is similar to Redistribute in Kuper.

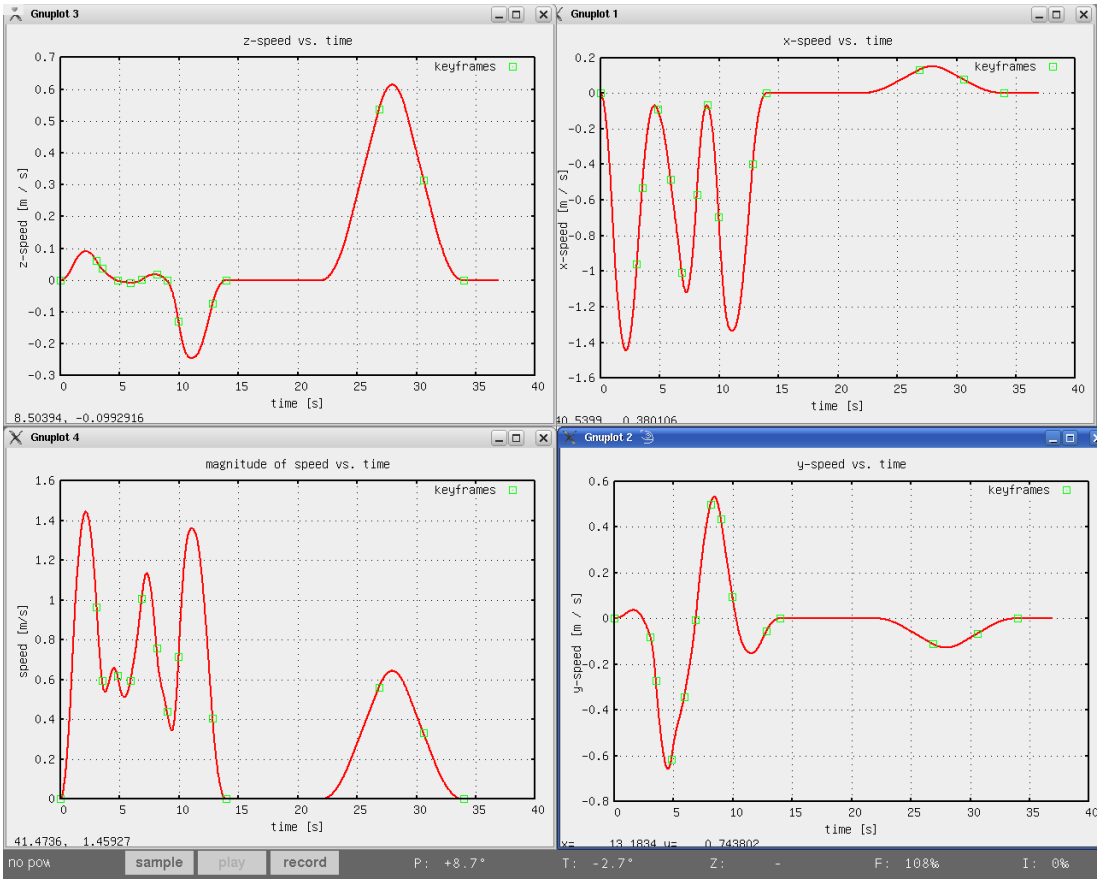
Unfortunately, at this time, the curves are not editable, only viewable. Stay tuned.

Below is an example of function curves for x-y, x-z, y-z for a fairly complex move.

In the example below, Gunplot 1 in the upper right, is the TOP view (x vs y). Gunplot 2 is the side view (x vs z) in the middle bottom and Gunplot 3 in the upper left is the front view (y vs z) of your move path.

The first key frame is always indicated by the solid green square. At the tenth Sample, you see a good example of how a dwell frame affects the move geometry: As the crane comes to a stop, it may head to another direction after the stop. The result is the visible acute angle in the curve. Also note how linear the move is after the dwell.





Above are the first order derivatives for the curves above. GunPlot 4 is the combined xyz speed of the camera.

Appendix A: Coordinate Space

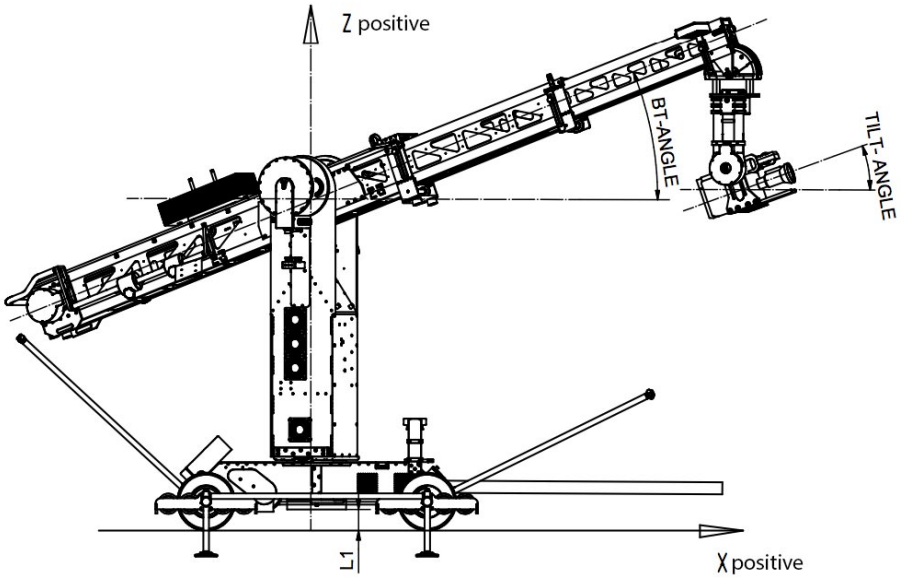


Figure 3: The TECHNODOLLY's coordinate system (side view).

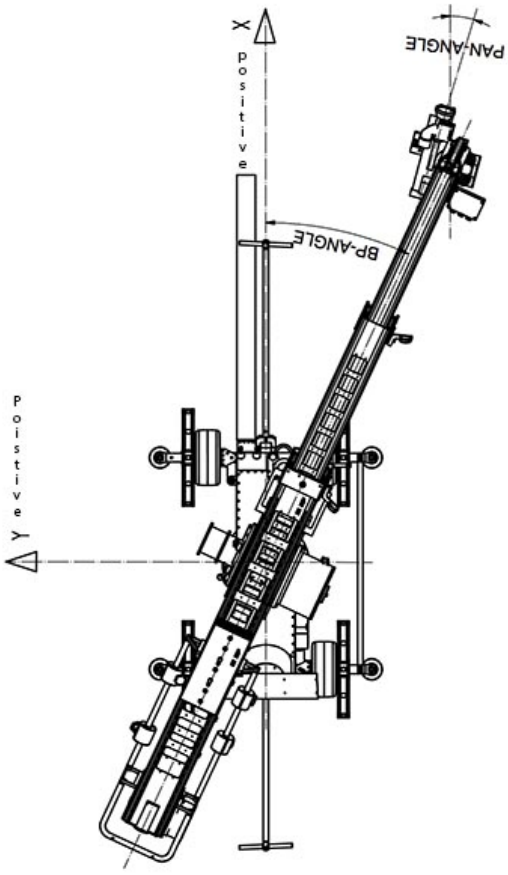


Figure 2: The TECHNODOLLY's coordinate system (top view).

TROUBLESHOOTING: Before you call

As Soon As I Press Start The Brakes Fire: Check all of your emergency stop buttons, there are 4. Is the desk and Rocker properly plugged in? Check the pan and tilt cable connections on the head. Visually inspect all cable connections. Clear all software limits for track and head.

The Crane Faults (brakes fire) When I Try To Move The Crane: There are two major causes of this problem. Are all three power mains plugged into 20amp circuits? Did any of those fuses blow? Or, is the arm manual brake engaged (the “back from lunch” error)? This causes the system to detect excess torque and shuts down.

Pan And Tilt Are Not Responding: First check to see if the Pan and Tilt motors are engaged or loose. Is the desk plugged into the crane and booted up? At the bottom left corner of the GUI, does the status indicator say "OK" or "No Link"? No link indicates a poor connection to the crane or air gap. Or, check in the 'Head' settings to see if the hand wheels or joystick boxes are checked. Check the cable connections for the encoders and motor drive cables. It is also possible there were position limits from the last job. Go to the HEAD menu and Clear Limits

When I try to start the crane, the head levels and then the brakes fire: The most likely cause is from old axis limits being violated by the current crane position. Go into the HEAD and CRANE menus and clear all limits on Pan, Tilt, Roll and especially Track.

When I start the crane, the head spins and the head leveler goes askew (brakes may or may not fire): This is an indication that there is a short in the logic connection between the desk and the crane. There should be a 50 ohm resistance between the center pin and ground conductor of the logic cable. Continuity is a sign of a short. Try to isolate the connector with the short and repair it.

The desk computer won't boot at all: Try swapping SSD drives first. There are a few things to try if that does not succeed. Try switching from the DVI video out to the VGA out to the monitor. Check that all rear connectors are properly attached. If all that fails open the top of the desk and re-seat the PCI cards on the motherboard.

The desk computer boots part way, but hangs before loading the log in screen: Try switching from DVI to VGA, or if you don't have a VGA cable simply disconnect the DVI cable and let the computer boot 'blind'. Restart the computer after 5 or so minutes with the DVI connected.

I can't save to my USB stick: Remove the USB device from the back of the computer and try another port, when a prompt come up about the USB drive, click 'Cancel' not 'OK'. It may be necessary to reboot the computer if repeated attempts fail. USB drives should be formatted to FAT. Mac and NTFS formatted disks cannot be read.

Position window Export Values are blank or Zeroes: Go to Settings/Data Export Settings and change data export to Binary under the real time export settings.

The Head Pans or Tilts Unexpectedly in a Move: You likely have Targeting turned on in the *Settings/Interpolation Settings*, or *Settings/Move Settings* under the Interpolation tab

After Importing a move the head and/or arm try to rotate more than the cables will allow: This is likely due to the Pan, Tilt, Roll or Boom Pan having multiples. Try reimporting the fbx move with the box checked to automatically determine PTR/BP multiples. If opening a move made on another crane, you can use the File/Edit move _BAK file to change the number of multiples to match your crane's configuration. You can also create a simple (dummy) move, save it, and view your crane's current axis multiples.

After importing fbx move the Go To works but the crane won't go into play, or faults: This is most likely because the crane cannot physically reach the desired go to position. Use Transform to adjust the move path or re-import the fbx file with a track position closer to the start of the move. Remember, the TD is very literal about the imported coordinates, they are absolute, not relative. Use the View/Position window to help determine where to place the base.

Changing Desks: You can swap desks so long as you edit the config file found at */usr/crane/settings/config/config.xml*. Use the Emac editor in Linux to change the crane serial number to match

the number at the rear of the crane arm. Access Emac with RMB on the config file icon and go to “Open with” and open *Utilities/Editors/Emac*

Move Won’t Start from Bloop button: The ‘dead man’ switch on the rocker needs to be depressed halfway, the yellow crane lights should solid on, the timeline visible (in Play mode) and the move needs to be at zero on the time line. On the right side of the desk, the yellow LED above the Path rocker should be illuminated, indicating the ‘dead man’ button is properly pressed half way. Try going backwards in the move to ensure it is at the very start of the timeline.

The program has disappeared, how do I get it back? If you minimized the window, open the Linux control bar, usually hidden in the upper left corner. You will see a greyed X about halfway down. LMB will maximize the window and no work will be lost. If you clicked on the X in the upper right corner, ther should be two Terminal style windows open. In one will be instructions on how to re-open the software or shut down the computer. Type the letter ‘n’ and enter. In this case, unsaved work may be lost.

I went to *Actions/Sample Replace* but the wrong key frame was replaced! The Sample Replace command replaces the key frame number indicated in the FRAME window at the top of the TDesk.

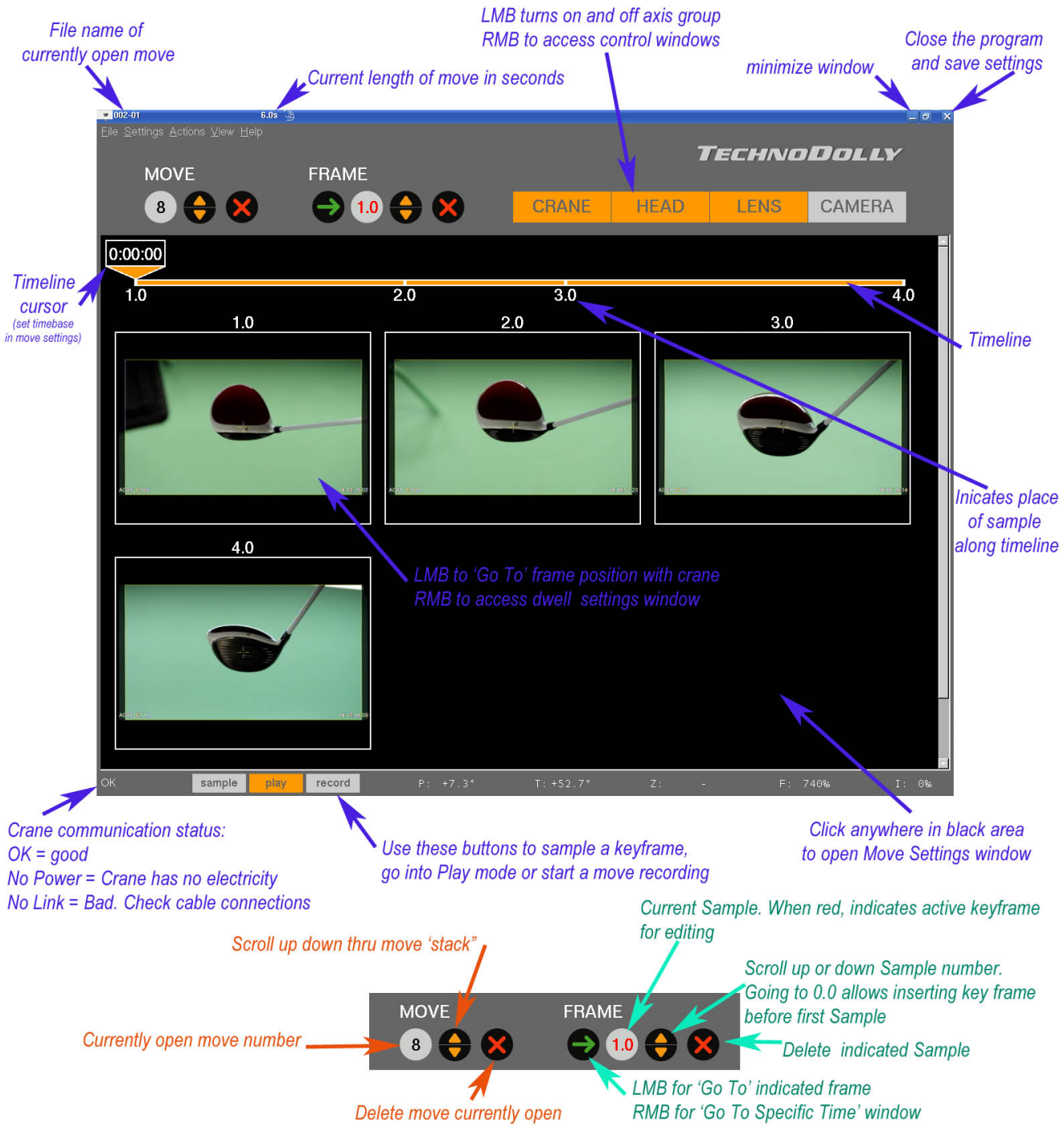
I set up Targeting but it doesn’t look right at all! Be sure Targeting is selected in either *Settings/Interploation Settings* or *Move Settings* under the *Interpolation Tab.* Be sure your Geometry settings are correct, pay special attention to the selection of camera being on the right or left side of Tilt motor and is L4 a negative value? If you Scaled the lens, was it in meters? Check your lens calibrations. Try the target selection steps again.

I programmed a move but the director wants to add a move before the current start of the move: Click the down arrow under FRAME until the Sample number is 0.0 . You can now insert a Sample before your current Sample # 1. The previous Sample 1.0 will be automatically renamed 1.1.

When I do a ‘Go To’ the crane moves to the right place but the light keeps blinking and the timeline won’t come up: If you are do a ‘Go To’ a key frame that has a dwell it can take while to truly achieve the position, especially if the dwell is quit long. This bug has yet to be resolved.

When we go to add or replace a focus Sample to the last key frame it creates a new Sample on the timeline near the last key frame: This is because there is a dwell on the final key frame. RMB on the image of the final Sample and make the dwell value 0, then Sample the position again. This bug has yet to be resolved.

The move we key framed is not repeating, some thing way off! More than likely Override is enabled on Pan, Tilit, Roll, focus and/or Zoom. Make sure the Override function is disabled for all axis when frame accurate repeatability is desired.


File name of currently open move
Current length of move in seconds
LMB turns on and off axis group
RMB to access control windows
minimize window
Close the program and save settings
File Settings Actions View Help
TECHNODOLLY
MOVE
FRAME
8
1.0
CRANE
HEAD
LENS
CAMERA
0:00:00
Timeline cursor
(set timebase in move settings)
1.0
2.0
3.0
4.0
Timeline
Inicates place of sample along timeline
LMB to 'Go To' frame position with crane
RMB to access dwell settings window
OK
sample
play
record
P: +7.3°
T: +52.7°
Z: -
F: 740%
I: 0%
Crane communication status:
OK = good
No Power = Crane has no electricity
No Link = Bad. Check cable connections
Use these buttons to sample a keyframe,
go into Play mode or start a move recording
Click anywhere in black area
to open Move Settings window
Current Sample. When red, indicates active keyframe for editing
Scroll up down thru move 'stack"
Scroll up or down Sample number.
Going to 0.0 allows inserting key frame
before first Sample
Currently open move number
Delete indicated Sample
Delete move currently open
LMB for 'Go To' indicated frame
RMB for 'Go To Specific Time' window