



Installation Instructions for Meade LXD55 / 75 Belt Drive Conversion & Motor Gear Box Tune-Up



MOUNTS & DRIVES

TIPS & TRICKS SERIES

FEBRUARY 2007

WARPSDRIVE

There has been much discussion regarding loose gears, setscrews, rubber-banding and inconsistencies in the tracking and go-to capabilities of some LXD55 / 75 mounts.

This modification kit will provide the parts needed to replace the final section of the gear train - the motor and worm gear with precision toothed pulleys and Kevlar timing belts to eliminate any gear slop in the final drive stage and greatly reduce the "rubber-banding" effect. Since it requires some disassembly of the motor units, it also includes photos and instructions for cleaning and re-lubing of the Motor Gear Boxes and adjustment of the worm.

In general, the mount just seems to behave and perform better with this modification. The end result is a completely reversible modification that fits within the standard motor housings.

ALL MODIFICATIONS AND ENHANCEMENTS ARE DONE AT THE RISK OF THE OWNER.

Pre-Setup Check Your Inventory...

Kit Contains:

- 2 - 30 Tooth Motor Shaft Pulleys
- 2 - 32 Tooth Worm Shaft Pulleys
- 2 - Long 4-40 Stainless Set Screws
- 6 - Medium 4-40 Stainless Set Screws
- 2 - Toothed Belts
- 8 - Stainless Steel Allen Motor Housing screws
- 4 - Button Head or Beveled Motor Case Screws
- 2 - Flat wooden popsicle stick
- 1 - Allen .050 wrench for set screws
- 1 - Allen 3/32 wrench for 8 stainless screws
- 1 - Allen 2mm wrench to fit button screws
- 2 - Popsicle Sticks

Tip: Use the above check boxes to verify and identify the individual parts. Keep the parts in a tray or on a cloth covered surface so that the tiny set screws can not roll off of your work surface and out of your work space



Items are packaged as follows:

- 1 - Large plastic bag labeled **WarpsDrive** containing:
 - 1 - Medium Bag Labeled **MP** containing:
 - 2 - 30 Tooth Black Pulleys - Motor Shaft
 - 1 - Kevlar Toothed Timing Belt
 - 1 - Medium Bag Labeled **WP** containing:
 - 2 - 32 Tooth Black Pulleys - Worm Shaft
 - 1 - Kevlar Toothed Timing Belt
 - 1 - Small bag labeled **MP-1** containing:
 - 4 - Short Stainless Steel Set Screw
 - 1 - Allen wrench (.050) for all set screws
 - 1 - Small bag labeled **WP-1** containing:
 - 2 - Short Stainless Steel Set Screw
 - 2 - Long Stainless Steel Set Screw
 - 1 - Small bag labeled **MC or MC-A** containing:
 - 4 - Buttonhead Steel Screws (**MC**)
 - 4 - Beveled Steel Screws (**MC-A**)
 - 1 - Allen Wrench (2mm)
 - 1 - Small bag labeled **MH** containing:
 - 8 - Black Coated Stainless Steel Screws
 - 1 - Allen wrench (3/32)

Additional Items you will need:

- 3/16" Allen wrench to loosen screw holding RA motor assembly to mount.
- 5/32" Allen wrench to loosen screw holding DEC motor assembly to mount.
- 1.5mm Allen wrench to loosen the 4 screws holding motor housing to motors.
- Small Phillips head screw driver to fit the 4 screws holding the black motor housings together.
- 1 - 2 hours time and patience.
- Cleaning alcohol, cotton swabs, etc.
- Small towel or pad on which to work.



Optional Tools

Procedure - Set Up:

- Read entire directions **BEFORE** starting)
- Move the mount to a comfortable position next to your work space - make yourself comfortable - the conversion takes about 1 - 2 hours depending upon your comfort level with tools and experience. Verify that you have all the parts needed as listed above. Lay them out on the table so you are not hunting for them during the conversion. Some of the parts are very tiny.

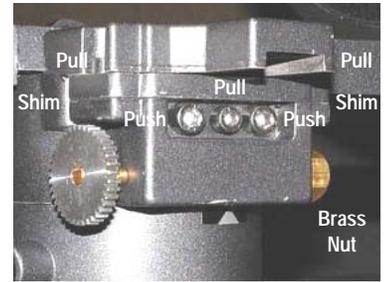
Tip: A borrowed muffin pan from your wife's pantry makes a good parts sorting bin while you are working.

- Disconnect all power from the mount.
- Unplug all connections at the LXD control panel on the RA Drive.
- Remove the OTA and dovetail from the mount.
- Remove the Counterweights and Counterweight Shaft from the mount.
- Loosen the DEC and RA Locks - Put the mount in Polar Home Position.

Note: Now would be a good time to test / adjust your worm to alignment to minimize slop and play and to clean them of the stock grease. Re-lube with a high quality lubricant. This is a tedious adjustment but one of the most rewarding when it comes to tracking, slewing, go-to's, etc.

Adjusting The Worm:

After removing the motors, remove the worm housings from the mount by unscrewing the center of the three screws shown in the picture. There are also two screws accessible from the top of the saddle.



Note: The three screws pictured final adjustments for alignment of the worm. The center bolt screws into the mount to pull the worm against the worm gear. The two outer bolts adjust the angle of the worm. Ideally, the center axis of the worm shaft should be tangent to the circumference of the worm. Do NOT touch these bolts while removing the worm housing as they are adjusted from the factory. Only after reinstalling the worm housing to the mount should you make fine tune adjustments with the two outer bolts to adjust the "tilt" of the worm relative to the worm gear. The two outer bolts work in a push-pull arrangement with the center bolt. Tightening the two upper bolts will pull the worm housing slightly upward which will also tighten the worm against the gear. I found that a thin shim washer of nylon or brass over these two upper bolts between the saddle and worm housing aided in fine tuning this adjustment.

This is a picture of a stock worm in its housing. The large brass nut on the end opposite the gear is for adjusting the amount of "play" of the worm. Removing this nut exposes a threaded sleeve which holds the worm in place. Adjusting the inner sleeve will be the critical adjustment. The worm does NOT have to "spin" freely - just turn in a smooth non-binding motion.



If properly adjusted, you should be able to grab the top of the mount (saddle) and feel no movement if you try to twist the mount around the RA or DEC axis.

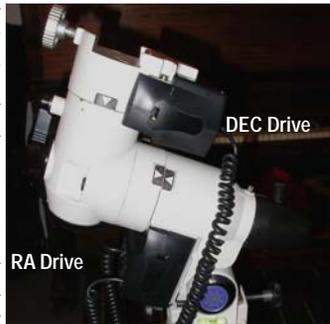
Clean out the stock sticky grease and re-lube with Lubriplate or SuperLube. You should be able to hand turn the gear (or pulley) on the end of the worm shaft with a smooth non-binding feel. When the gear moves, the mount should move - no slop - no loose movement.



Dissassembly Of The RA Motor Housing:

This is the hardest part of the conversion, so once you get through this - you are home free.

- Using a 3/16" Allen wrench, insert in the hole at the rear of your mount - just above T-Handle ALT adjustment bolt and engage the bolt which holds the RA Motor Assembly to the mount. Remove the screw as you hold the motor housing in place with your other hand. As soon as it releases, place the motor housing on the table in front of you with the control panel facing down.



- Using the small Phillips screw driver, insert in the four holes in each corner of the black plastic motor housing and gently unscrew the 4 tiny screws which hold the top and bottom halves of the black motor housing together (DEC drive pictured here - RA drive disassembles in the same manner). Once loose, separate the two halves being careful not to strain any wire connections. Note the positioning of internal wire and the choke for reassembly later.

- Rest the motor on the table being EXTREMELY careful NOT to touch the now exposed very delicate encoder wheel at the end of the motor opposite the gear. Do NOT touch it or allow it to contact the table or work surface. Using a 1.5mm Allen wrench,



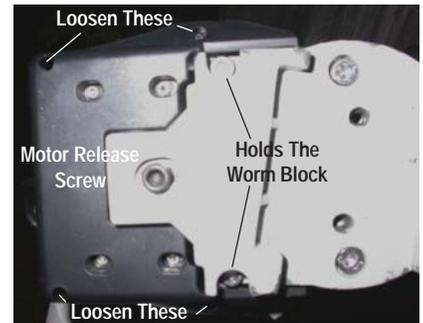
remove the 4 small button screws holding the black plastic motor case to the motor. Set this motor case to the side. You now have a fully exposed LX55 / 75 motor.

- Using the .050 Allen wrench loosen the set screw in the gear and gently pull the gear off of the shaft. Clean the shaft if has any left over thread locker adhering to it using some fine sandpaper, steel wool, x-acto knife - whatever it takes. Wipe the shaft off with some alcohol to remove any oils or residues.

Note: Now is the time to do the Motor Gear Box Tune-Up if you plan on doing so. Or you can proceed to the DEC motor disassembly and do the gear box tuneup when both motors are removed from their mounts.

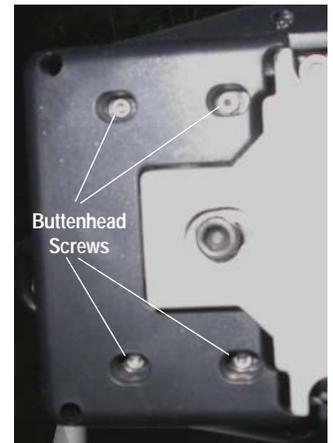
Dissassembly Of The DEC Motor Housing:

- Looking from the top of the mount, use the small Phillips screw driver to loosen each of the 4 screws down inside the holes near each corner of the black plastic motor housing. This should release the bottom half of the housing - carefully remove it (being careful of the delicate encoder) and set it aside.

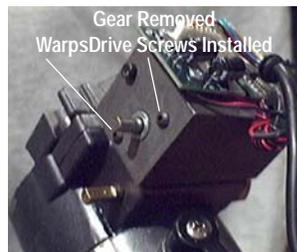


Carefully loop the coiled cable up over the mount out of the way in a manner which will not stress the delicate connections to the motor controller board.

- Using the Allen wrench, loosen the 4 button head screws which are recessed in the 4 holes centrally located in the top half of the black plastic motor housing. This will release the upper half of the black plastic motor housing from the motor. Set the cover aside. You now have a bare motor assembly still attached to the mount by the one large Allen bolt visible from the top of the mount.



- Using the .050 Allen wrench, loosen the set screw on the motor gear and remove the gear from the shaft. Clean the shaft as you have did previously on the RA assembly. Manually turn the gear on the DEC worm to check for slop and excess play. Now is a good time to clean and adjust as previously described. If you are satisfied with the worm's adjustment, proceed.

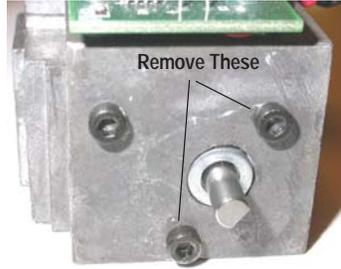


There are two different screw replacement sets. There are the standard button-head screws in bag **MC** and the zero-clearance screws in **MC-A**.

Replacing The Motor Block Screws:

This next procedure will be repeated for both the DEC and RA motor assembly.

- Looking at the motor block without the gear, you will notice there are 3 black Allen head screws protruding from the motor block. The two closest to the motor shaft (covered by the gear you just removed) will have to be replaced with the button head or beveled screws included in the kit to allow for tighter clearance to allow the new converted drive to fit inside the stock black plastic motor housing.



Note: Now is the time to do the Motor Gear Box Tune-Up if you plan on doing so before replacing the screws. Resume the re-assembly at this point after you finish the Motor Gear Box Tune-Up.

- Using the 3/32" Allen wrench (from the **MH** bag, remove (one at a time) the two screws closest to the motor shaft and replace with the button head screws using the 2mm wrench from the **MC** bag.
- Repeat this procedure for the remaining drive using the remaining two button head screws from the **MC** bag.



Zero Clearance Modification:

- If you want to gain an extra 1/16" clearance between the pulley and the motor housing, you can use the four stainless steel bevel head screws which are included in the kit bag **MC-A**.
- To use the beveled screws, you will need a countersink / beveled bit like the one pictured here. They are available at most major hardware stores for around \$4.00.



Buy cheap as you only need it for four holes.

Note: If you are doing the Motor Gear Box Tune-Up, perform the following three steps after you have removed the motor from the block

- Remove all three of the original black screws holding the motor into its mounting block. Very carefully push the motor slightly back in its block until the protruding motor shaft is flush with the front of the block. Be careful of putting any strain on the electrical wiring.
- Holding the motor upside down so that the motor shaft and screw holes are facing downward, carefully drill out the two inner holes with the bevel bit. The metal is soft and very little pressure is needed. When you finish, the beveled holes should look like the ones in the picture. Test fit the screws to be sure you have gone deep enough with the bit.



- Shake and blow out any shavings that may have gotten through to the inside and then reassemble the block with the new screws.

The new beveled screws should be flush or just slightly countersunk below the surface of the mounting block as pictured.



Progress Summary:

At this point, you should now have two motor assemblies that are ready for their pulleys and to be mounted back onto the mount. You should have already completed:

- Motor Gear Box Tune-Up.
- Replacement of the motor mounting screws.
- Worm cleaning, re-lubing and adjustment.
- Adjustment of the worm to the worm gear.

If you are ready to remount the motors and pulleys, please proceed to Page 9.

Motor Gear Box Tune-Up:

Setup / Tool Check...

Tools You Will Need:

- Assorted Allen Wrenches (see pictures)
- Small Phillip's Screwdriver
- Wire Cutters / Sharp Scissors
- Toothpicks
- Tweezers
- Single Edge Razorblade
- Lubricating Grease
- Application Paddles (wood coffee stirrers)
- 1 - .050 Allen wrench for set screws
- 1 - 3/32" Allen Wrench
- Shallow Dish and Fresh Turpentine
- Old Toothbrush
- Q-Tips
- Ultra Flat Black Paint (optional)
- Red Felt Tip Marker
- Shrink Tubing / Electrical Tape

These are the wrenches that I regularly use in working on my mounts. The ball-ended Allen wrenches are available at Home Depot for about \$19.00 a set. They are made by Husky and include the following sizes:

Metric: 1.5, 2, 2.5, 3, 4, 4.5, 5, 5.5, 6, 7, 8, 9, 10

SAE: .050, 1/16, 5/64, 3/32, 7/64, 1/8, 9/64, 5/32, 3/16, 7/32, 1/4, 5/16, 3/8

The ball end seems to offer a much better grip on some of the tiny set screws used in this mount. It has easily removed and tightened setscrews that other normal wrenches seem to just spin in. Highly recommended.



Another set of micro wrenches that I find indispensable when working with these mounts and their many tiny set screws.

**GOOD ENCODER POSITIONING
WITH 0.9MM ALLEN KEY**

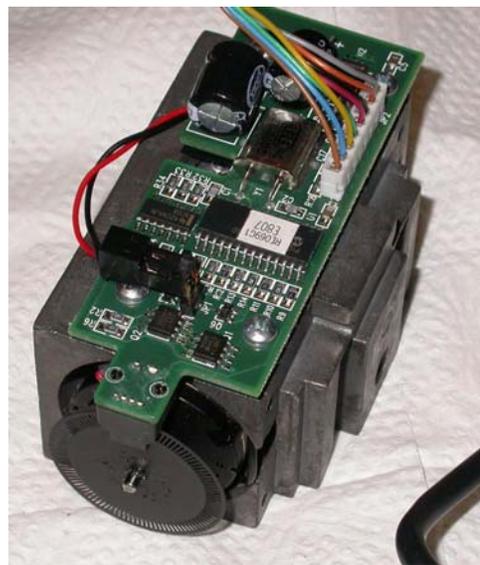
Note: This procedure can be done with the encoder in place - if you are careful. Removing the encoder requires a very tiny 0.9mm allen wrench and the tiny set screw is easily stripped. If you try to remove it - proceed with extreme patience and care.

Here you see the bare motor assembly removed from its plastic housing. Notice the delicate encoder (shiny slotted disc on the left end of the motor). It is absolutely essential that this wheel be straight, clean, tight on the shaft and nearly centered with the emitter and the receiver. Centering does not have to be absolute - just be sure it is not bent or rubbing against either of the emitter or the receiver.



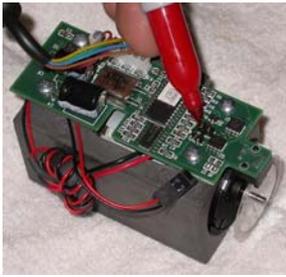
The white wire block at the upper left appears to be a removable plug - it is not. Do not pull or try to pry it loose from the board.

Caution: Caution: do NOT touch the encoder disc with your fingers as you will leave an oil residue which will attract dust and pollen in the air. If you do touch it, clean it with a very soft, fine brush and denatured alcohol or acetone.



This is a picture of my finished motor assembly with replacement encoders that have been painted with several very light mist coats of **Krylon Ultra Flat Black**.

The replacement encoders are available from:
<http://www.lxd55.com/order/encoders/>

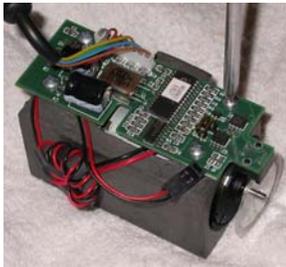


The plug with the red and black wires are the wires going to the motor and is removable. Note the orientation of the wires and mark the pin for the red wire with a red marker.

Caution: This small controller board has several integrated circuits on it and is therefore

susceptible to damage due to static discharge. I recommend touching something that is grounded to drain any charge from yourself each time you sit down to work on or handle the board. In 40+ years of handling electronics, I've never had a piece of electronics damaged by static electricity - but you don't want this to be the first time.

After removing the red / black wire plug and marking the red pin, use a small Phillip's screwdriver to remove the 4 shiny screws holding the controller board to the motor housing. Be careful so you don't slip off of the screw and damage the board.

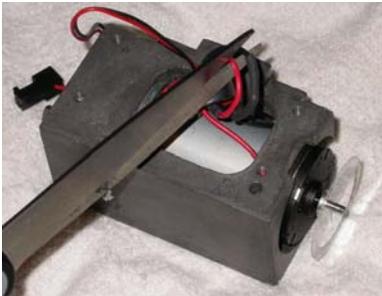


Note: There are 4 very small nylon spacers under the board on each screw which holds the board away from the motor housing. Be careful not to drop and lose these tiny spacers.



Once the controller board is removed from the housing, take a

small pair of wire snips or wire cutters and cut the two wires as pictured. If you look closely, you can see where the wires have been cut previously and then spliced and covered with shrink tubing. If you cut and splice in this same area - everything will look the same as a stock setup. You will notice a small metal "donut" that the wires are wrapped around. This is a ferrite choke to suppress any RF energy emissions which may be emitted by the motor wires - causing interference in nearby radios/tv's or even the AutoStar hand controller.



Note: Since I did not see the need for this choke, I removed the ferrite donut and thus shortened the wires considerably. Running the motors next to my TV, computer, wireless lan and and stereo exhibited no unwanted interference. This option would be your call.



Remove the three allen head screws on the end of the motor housing where the "keyed" shaft emerges from the housing.



Once these three screws are removed, the motor will slide out of the housing.

Note: Take note of how the wires are routed and be careful not to stress them as you slide the motor out of the housing. The encoder can be with a very tiny 0.9mm Allen wrench to loosen the set screw.



Caution: The connections of the wires to the motor are very delicate. Do not pull or put un-neccessary strain on these wires. If you do happen to pull one loose - it probably can be fixed by carefully soldering it back to one of the tabs visible from the encoder end of the motor. A wrap of electrical tape around the end of the motor holding the wires against the motor body will keep the wires tucked against the motor and remove the opportunity for excess stress.

Carefully remove the two screws that hold the gear cover casing to the motor. Be careful not to let the gear housing come off - hold it in place as you remove the screws.

Hold the motor so that the motor shaft and shiny gear housing is pointed upward. As you hold the motor shaft in place by placing your finger on the end of the shaft, slide the motor housing up and off to expose the internal gearing. Note the position of the gears before removing any of them.

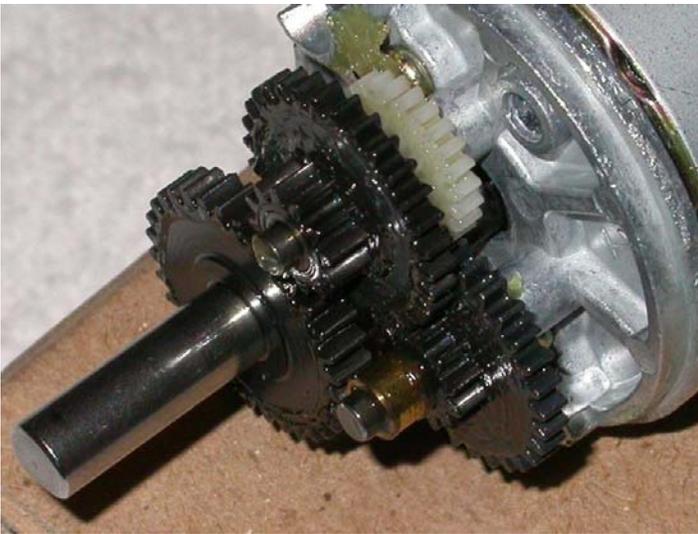


REMOVING THE GEARS...

Once the gears are exposed, grasp the larger "keyed" motor shaft and lift it out of the housing. Be careful as there is a washer/bearing sitting directly on top of the large black gear and there is a very tiny little washer that goes over the small spindle at the bottom of the shaft. The gear itself is attached to the shaft and does not move.



THE MAIN KEYED GEAR AFTER IT IS REMOVED FROM THE HOUSING. BE CAREFUL NOT TO LOOSE THE TWO WASHER-BEARINGS AS PICTURED BELOW.

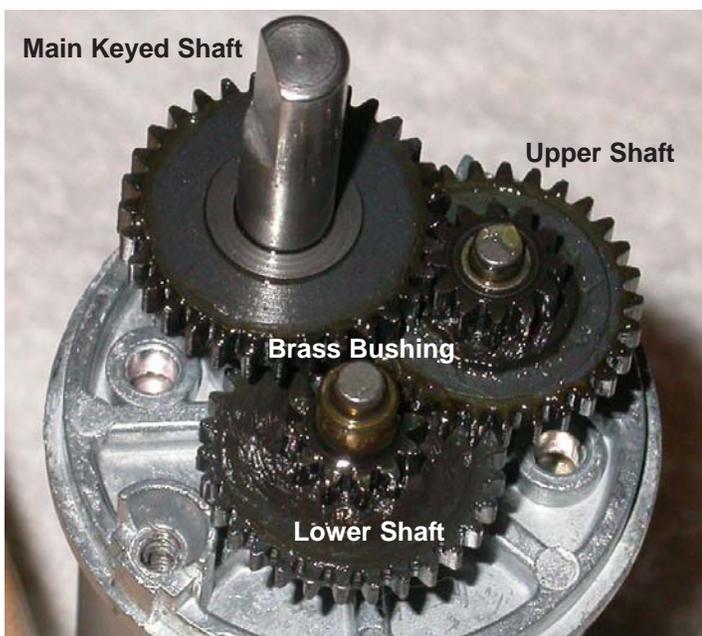


THE INTERNAL GEAR CLUSTER SHOWING THE STOCK STICKY GREASE AND LOTS OF PLASTIC DEBRIS



This washer sits on top of the plastic gear.

This washer fits over small pin at bottom of shaft..



Main Keyed Shaft

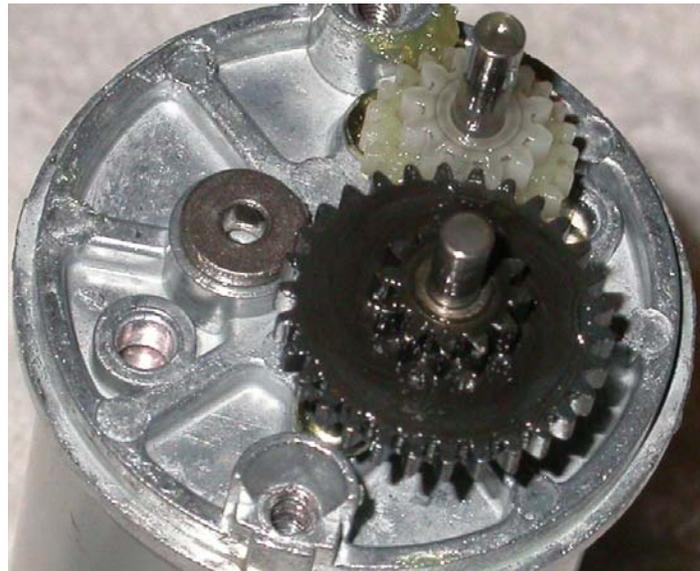
Upper Shaft

Brass Bushing

Lower Shaft



MAIN SHAFT REMOVED. THE OTHER TWO SHAFTS DO NOT COME OUT - THE GEARS SLIP OVER THE SHAFTS.



Remove the large black gear from the lower shaft.



Remove the large black gear from the upper shaft.

LARGE GEAR FROM UPPER SHAFT



LARGE GEAR & BRASS BUSHING FROM LOWER SHAFT

Remove the small brass bushing / bearing from the lower shaft.

Remove the small white gear from the shaft.



BRASS BUSHING FROM LOWER SHAFT

Note: Directly under the brass bushing is another small washer between the brass bearing and the gear face.



The small pinion gear on the motor shaft does not come off.

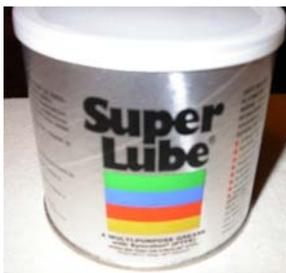


CLEANING THE GEARS...

I used a white (easy to see small washers that drop off of the shafts and gears while cleaning) cool whip container (cause I like cool whip) with about 3/4" of fresh turpentine (mineral spirits will also work) and an old toothbrush to clean the sticky original grease from the gears.



Once cleaned, it's time to re-lube and re-install the gears in the reverse order of removal.



I've tried several different lubricants and had settled on white lithium grease but change happens and I have now changed my "preferred" lubrication to SuperLube. It is 100% synthetic, clear, resists water, has PTFE particle suspension, does not run and is super slick.

You can read more about here:

http://www.super-lube.com/product_description.htm

I purchased mine from:

<http://precisionreloading.com/superlube.htm>

Note: In its out of the tube or tub form, SuperLube is extremely good - although a little "stiff". In my mounts, I made my own custom formulation by filling a shot glass almost to the rim with the SuperLube and then adding about 3/4 of a cap of 100% pure synthetic motor oil (Mobile 1, Penzoil, etc - just make sure it is NOT a blend but 100% synthetic). Mixing this up gave me a very nice viscosity which gave super smooth but-tery like movement in all parts of my mount with no running and no break-down.



Re-assemble the gear box in reverse order adding lubricant to each shaft, each washer/ bearing, each gear face all gear teeth. Make sure to put a large dab on the end of each shaft, on the inside of the gear housing where the indents are to hold the gears and on the motor pinion gear. I was not afraid to use a lot of lube as the gear box is pretty much sealed and the SuperLube does not run - I covered the whole gear cluster with lube.

Once you have the gears lubed up and back in place, carefully put the gear casing back in place and tighten down the two screws holding it in place. Carefully turn the encoder end of the shaft a couple of times to ensure you have nothing binding and smooth rotation. (I touched the two bare ended motor windings to a AA battery to allow the motor to turn a few rotations reverse the wires to rotate it in the opposite direction - and confirmed all was operating as it should).

REASSEMBLE THE MOTORS...

Follow the directions in reverse till you have the motor mounted back inside the housing. Solder the connections to the motor wires, remount the controller board (don't forget the spacers under the board), plug the two red/black wire plug back in place with the red wire towards the middle of the board (away from the encoder) and you are finished.

Enjoy Smoother - Quieter motoring!



**DRIVE GEARS REPLACED WITH
WARPSDRIVE BELT CONVERSION TIMING PULLEYS**



BEFORE CONVERSION



AFTER CONVERSION

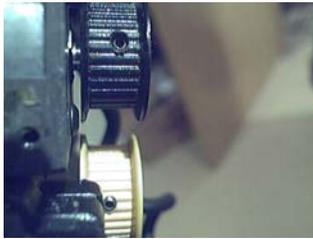
Assemble The Pulleys:

At this point, you should have completed any mechanical adjustment, cleaning, re-lubing or other items you want to accomplish. These steps will mount the pulleys and re-assemble the motors to the mount.

Repeat these steps for both motors and both worms.

- Take one of the 2 smaller pulleys from bag **MP** and remove the standard black set screws using the .050 wrench from bag **MP-1**.
- Take 2 of the 4 short set screws from bag **MP-1** and carefully thread it into each of the holes in the pulley.

- Press the pulley onto the motor shaft getting it as close to the motor body as possible without it rubbing on the two button head screws you just replaced in the motor body. I used a business card as a “guage” in between the pulley and the head to set my spacing. If you have a set of feeler guages, you can use the thinnest one that will



- prevent the pulley from touching the head of the button head screw. Tighten the remaining set screws against the motor shaft. Do not over tighten so as to strip out the set screw head - remember, you now have **2** set screws holding the pulley to the shaft.

- If you haven't already, using the .050 Allen wrench, loosen the set screw on the worm gear shaft, remove it and clean the shaft as you did with the motor shaft. Wipe with alcohol to remove any oils or residue.

- Take one of the 2 larger pulleys from bag **WP** and remove the standard black set screws using the .050 wrench from bag **MP-1**.

- Take 1 of the 2 short set screws and 1 of the 2 long set screws from bag **WP-1** and carefully thread it into each of the holes in the pulley.

- Press the pulley on to the worm shaft lining up the long set screw with the flat area of the shaft. Tighten the long set screw and then the short set screw.

You now have installed 2 black motor pulleys each with 2 new short **knurled cup point** stainless steel set screws installed and 2 black worm pulleys (pictured yellow in the photos as it was a prototype) with 1 short and 1 long **knurled cup point** stainless steel set screw installed. These new screws will provide a better grip on the shaft and the serrations in the cup are designed to resist counter clockwise rotation. They should virtually eliminate the “loose set screw” problem which occurs in these mounts. And to further decrease the opportunity for a pulley to come loose there are now two set screws per pulley.



Note: Refer to the photos to check for the overhang of the worm pulley past the end of worm shaft. In the photos, the yellow pulley is the worm pulley (prototype photo). The worm shaft will be slightly recessed into the worm pulley to allow for better alignment between the two pulleys once they are remounted to the mount. Some experimentation may be needed with trial and error fittings to get the best alignment without the pulley rubbing against the black motor housing. Alignment does **NOT** have to be perfect in that the belts do allow for a small degree of error and flexing.

Re-Assembly Of Motors To The Mount:

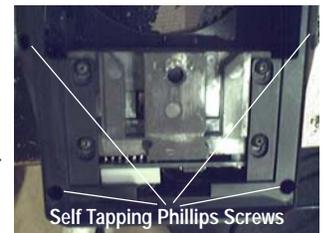
RA Motor Re-Assembly (Option 1):

Note: Read Option 2 Before Proceeding

- Be careful of the delicate encoder wheel: Place the half of the black plastic motor housing (without the control panel) on top of the motor and attach with 4 of the 8 supplied Allen screws (bag **MH**) using the included Allen wrench.

- Place a toothed belt over th motor pulley.

- Making sure that the belt is hanging loose and not binding, assemble the bottom half of the black plastic housing by lining up the 4 screw channels and retightening the 4 self tapping screws (that you previously removed) in each corner using the small Phillips screwdriver.



Note: Do **NOT** overtighten these 4 screws or you could strip, crack or break the channel.

- Holding the motor housing in one hand against the mount, re-thread the large Allen bolt you previously loosened from the back of the mount to secure the housing to the mount. Do **NOT** tighten, just have it tight enough to hold the motor housing from falling off. While gently lifting up on the motor housing with one hand, use the popsicle stick or other blunt tool of your choice to lift the belt up and over the worm pulley. This may be tight. Lifting, fiddling with the position of the motor housing will aid in giving you some slack.



Once the belt is over both pulleys, pull downward on the motor housing with one hand (to take up any excess slack in the belt) while you tighten the large Allen bolt to firmly secure the motor assembly to the mount.

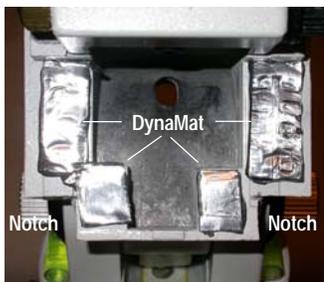
Note: A slight "twisting" pressure on the motor housing will aid in taking up slack. The belt does not have to be absolutely tight - you want just a very slight amount of slack.

- Visually inspect through the access "porthole" for any rubbing or binding areas. Take a breather - have a cold drink and move on to the next step for the DEC motor - a piece of cake.

RA Motor Re-Assembly (Option 2):

This option may seem a bit drastic, but is really quite simple and will make the installation of the RA Belt Drive and Adjustment extremely easy and precise. While it is NOT reversible, it is invisible and will not affect the mount should you decide to go back to the standard gear drive. You will need a small hacksaw or hacksaw blade or a dremel tool.

- With the RA Motor removed at the mount, take the hacksaw blade and cut a notch in each of the lower corners of the RA mounting plate. Note position and depth of the notches. This will allow access to the small Phillips screws that hold the top and bottom of the black housing together, allowing you to mount the motor while it is in the housing



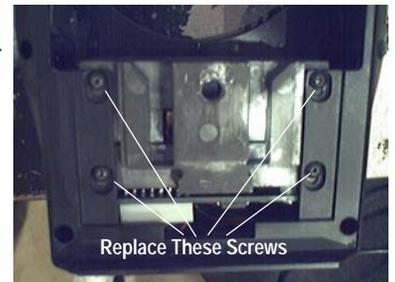
with open access for installing the belt and making tension adjustments.

Note: The shiny foil that you see in the picture are small strips of DynaMat. This is a self adhesive sound and vibration dampening material that is used extensively in the car audio business. As in these other pictures, you can see that I have lined all of my motor housings with the DynaMat which helps to reduce vibration and motor noise and then spray painted them with Krylon Ultra Flat Black Spray Paint. If you can not find a local car audio dealer that handles it, you can buy it directly from:



<http://www.dynamat.com>

- Be careful of the delicate encoder wheel: Place the half of the black plastic motor housing (without the control panel) on top of the motor and attach with 4 of the 8 supplied Allen screws (bag **MH**) using the included Allen wrench.

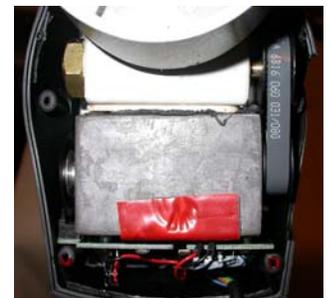


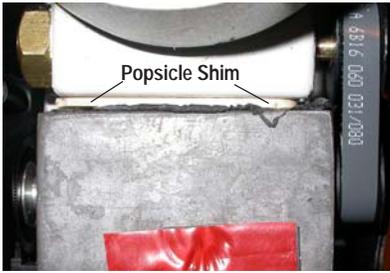
- You now have the motor mounted inside of the black plastic housing - ready to be mounted onto the mount. Holding this assembly in one hand, position it on the mounting plate (the plate you just cut the corner notches into) and insert the large allen bolt into the hole just above the T-Handle and tighten it just enough to thread into the motor block to hold the assembly in place. Do not tighten at this time.



ASSEMBLY IN POSITION

- Check the pulleys for alignment and make any adjustments necessary. Carefully install the remaining belt over the two pulleys. As you tighten the large Allen bolt that holds the motor and assembly to the mount, you will notice that it "pulls" the motor closer to the worm which





could result in too much slack in the belt. At this point you can place a shim or spacer between the motor and the mount to adjust the spacing. I used a small length of one of the popsicle sticks as a

shim between the motor and the mount to tighten up the belt. You do not want the belt too tight, it should have just a bit of flex. Once you get the desired spacing, tighten down the large Allen bolt to hold the assembly in place.

- Install the remaining belt over the two pulleys. Once the belt is in place, adjust its tension and tighten the large allen head bolt on the topside of the saddle.



Note: *You may have to start in on one side of the motor pulley and then turn turn it to wrap it around the pulley - kinda like replacing a bicycle chain in your younger days. Once the belt is in place, slide it back and forth to take up any excess slack in the belt while tightening the large Allen bolt to secure the motor assembly. Don't make the belt too tight - just not sloppy.*

Note: *I placed a large split washer over the large Allen bolt before installing it. This allows me to make fine tune adjustments on the belt tension just by slightly loosening or snug-ging up the bolt.*

- Assemble the remaining top half of the motor mount with the AutoStar Control Panel to the motor using the original 4 self tapping screws. You can access their mounting holes from under the mount using a short Phillips screw driver. Line up the screw channels (posts) and carefully tighten the screws once you have the assembly lined up and are sure there are no binding or pinched wires.

This completes the RA Motor Assembly Belt Conversion



- Using the 4 remaining small Allen screws and the Allen wrench (bag **MH**), reattach the upper half of the black plastic motor housing to the motor. Once again, be careful of the delicate encoder wheel.

- Carefully line up and the bottom half of the motor housing (making sure the rubber grommet on the cable is seated in the indent) and secure with the 4 self tapping screws using a small Phillips head screwdriver. Do NOT overtighten as this could crack or break the screw channels.



DEC Motor Re-Assembly:

- The appropriate pulleys should already be mounted on the DEC motor shaft and DEC worm assembly
- Mount the DEC motor to the mount with the large Allen bolt visible at the top of the saddle plate. Do not tighten all the way as this bolt is also used to adjust the final tension on the belt once installed. Be very careful not to touch or damage the delicate encoder wheel.



- Visually check for any areas that might be binding or rubbing.

This completes the DEC Motor Assembly Belt Conversion



Note: *The Captive Bolt holes shown in this photo is a modification detailed in another Tips & Tricks Guide to offer a more secure and rigid mating of the saddle plate (dovetail) to the saddle which improves the rigidity of the mount.*

Final AutoStar Adjustments:

- Plug in the DEC motor AutoStar and power supply.
- Turn on power and bypass all the alignment, date and time functions to get the **Telescope** menu.
- Enter the (value) for the AutoStar drive ratios and change the sign from (-) to (+).

Calculation for these ratios are as follow:

(multiplier) x (#worm teeth) / (motor teeth) x (worm teeth)

LXD55/75 Motor Multiplier = 0.01666666

Worm Pulley Teeth = 32

Motor PulleyTeeth = 30

Worm Teeth = 144

This yields:

.01666666 x 32/30 x 144 = 2.559998973

Rounding to 6 places, I use: 2.559999

In the AutoStar menu:

Scroll to SETUP - Press Enter

Scroll to TELESCOPE - Press Enter

Scroll to AS/RA Ratio - Press Enter

Enter the number: 2.559999 and change the sign to (+)

Scroll to ALT/DEC Ratio - Press Enter

Enter the number: 2.559999 and change the sign to (-)

- Perform a "Calibrate Motors" to make sure the drives are operating properly. After the calibration, run each drive at various speeds to check out operation.
- Remount your OTA, perform another "Calibrate Motor" and follow with an accurate drive training and you should be ready to go.

This completes your belt conversion. I think you will find that your mount has a much better "feel" and just behaves better in all operations.

A special thanks to **Mike Gray** for his initial testing and review which can be viewed at:

<http://www.wideopenwest.com/~mgray8351/BeltDrive.htm>

Feel free to email me if you have any questions at:

warpcorp@swbell.net

WarpsCorp Enhancements:

WarpsDrive Belt Conversion:

Single Axis: \$40.00 (includes shipping in US)

Dual Axis: \$74.95 (includes shipping in US)

Cup-Pointed Serrated Replacement Set Screws for Stock Gears

Eliminates The Loose Gear Syndrome

4 Hardened Steel Set Screws and Wrench: \$3.00

For Previous WarpsDrive Purchasers:

Set of 4 Zero Clearance Motor Screws: FREE

If you need the set screws or zero clearance screws: Send a SASE (self addressed stamped envelope) to:

David Sherfy

199 Stoneyview Lane

St. Louis, MO 63146

The \$3.00 payment should be 3 - 1 Dollar Bills inside the SASE
For Non-US customers - Email me for details.

Highly Recommended Items of Interest:

These are items which I have found and use which I feel are worth while to pass on to other Amateur Astronomy Enthusiasts

RACI (Right Angle Correct Image) Finders make your viewing more pleasurable. Here is *highly recommended alternative* to the popular Orion RACI selling for \$102.82 with mount & standard ground shipping.

Manish at **Agena Astro Products** offers an almost identical unit from GSO. An 8x50 RACI and includes the bracket & dovetail mounting base for **\$62.00** which includes shipping in the US.

That's a savings of over \$40.00.



It is available in White to better match your Meade OTA. I use it and found that the coatings on the Agena product seem to be just a little deeper in hue. Crystal clear views with well defined crosshairs. Adjustable focus and lens caps are included. The adjustable mount is a cinch to use.

AGENA

AstroProducts

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Put An End To Those Printer Blues...

Another item which I came across was the result of constant frustration when it came to printing. I have several Epson R300 color inkjet printers which are under constant use by my family and myself. These new printers offer fabulous printing quality with their multiple colors and now shades of colors. These new printers no longer use the standard 3-color and black cartridges, but instead are now using 6 and more colors /cartridges.



The problem is that they never all run dry at the same time and when one goes dry... your done. You can't just switch to black only printing - you have to go

out and buy a replacement cartridge for the one color that just went out. And to add insult to injury - the cartridges hold about a third as much ink as they use too. Progress?

In printing astro photos, I found that I was changing black cartridges almost as often as I was changing socks. At \$12.00 and per cartridge, replacing all six cartridges was starting to get a little pricey.

I recently converted to a **CIS (Continous Ink System)** bulk ink configuration from **Ink Republic...** joy, joy!

This system consists of six individual 100ml / 3.4oz bottles of ink connected through flexible tubing and an ingenious cartridge system which replaces the standard ink cartridges. The individual bottles of ink are less than \$12.00 each.

The kit also comes with a unique little circuit board device that fits in the print head / cartridge carriage just in front of the cartridges that "fools" the printer into thinking that the cartridges are always half full.



Some other systems make the printer think the cartridges are full (new) which forces the printer into having to have the jets re-aligned / purged as when you put in a new cartridge. This wastes ink.

The Ink Republic system does not.

I've tried several other CIS systems and while they all



seem to work, the color purity and saturation of the Ink Republic inks result in the best color - no noticeable difference from the standard Epson cartridges and ink. Granted, I have not tested them for durability in the sun or rain... but I do most of my printing, reading and displaying of prints indoors - so it just doesn't matter.

The system also worked better on my printer set up because as you can see, I have the printer elevated on a small platform so that the ink bottles are sitting lower than the printer. Some of the other systems I tried, had trouble pulling the ink from the lower level which resulted in bubbles in the lines and gaps in the printing. As you can see in the photos, they have self adhesive holders to hold the feed tubing in place. (I did cut a small notch in my printer lid to allow the cover to close when not in use. It was no big deal as I just ordered a new replacement cover from Epson should I ever decide to go back to the old ways (no way unless I am selling the printer).



The cost of the kit ranges from \$199.95 to \$275.00 but remember this is a one time cost and the larger ink supply costs no more than standard cartridges. It will not take you long to save the cost of the kit - just three changes of your cartridges and you are there.

THE BOTTOM LINE...

This system is easy to install.

It will save you money.

It will save you time.

Print quality is virtually indistinguishable from standard Epson cartridges (in my usage).

It will end the "out of ink" frustration factor and most importantly...

**OPERATION OF THE INK REPUBLIC CIS SYSTEM
HAS BEEN FLAWLESS.**

<http://www.inkrepublic.com>