A publication from the Yahoo Group - WarpsCorp. Providing solutions to problems, answers to questions and ideas to share among the amateur astro community. We welcome you at:
http://groups.yahoo.com/group/WarpsCorp/

OPTIMIZING YOUR LXD55 SN REFLECTOR & AR REFRACTOR

MODS & ENHANCEMENTS **OTA ENHANCEMENTS** **VOLUME 3**

This guide represents the work and ideas of members of the Yahoo User's Group: "LXD55Telescopes" and WarpsCorp. More information can be had by becoming a member and active participant of these groups. All ideas, comments and questions are welcome and hopefully you will find it an abundant resource for ideas and answers to your questions.

The ideas and procedures contained within have been implemented and tried by users of the group and submitted in good faith in an attempt to maximize your enjoyment of your LXD55 Telescope.

All modifications and enhancements are done at the risk of the owner.

Having said this, please feel free to discuss and seek further information within the group.

Flocking The OTA...

There have been reams of information written and hours of arguments presented regarding the flocking of the inside of the OTA (Optical Tube Assemblies) of consumer grade telescopes. The primary justification to undergo this procedure is to reduce the amount of internal reflections and therefore enhance the contrast and detail available when viewing faint objects.

Note: The products mentioned are ones which myself or other users have had personal experience with. This does not represent an endorsement of any particular product or dealer. The prices are for reference only as this is what I found available.

Basically, you are making the inside of the telescope "tube" darker. Many different methods have been presented and tried - everything from crushed walnut shells and saw-dust spray painted flat black to adhesive black velvet and/ or felt.

The easiest and fastest way to darken the tube is to remove the optics and spray the inside of the OTA with a good even coat of Krylon Ultra Flat Black spray paint. This is available at almost any hardware store. This will almost always give you an immediate improvement in the degree of darkness of the inside of your OTA.

Note: While most consumer grade scopes are simply painted on the inside of the OTA, there are some premium scopes which are already treated internally to reduce reflections. These scopes are probably best left as they come from the manufacturer.

Velvet and felt seem to be the most widely used material and there are many web sites detailing this installation. The flocking material is generally available from several manufacturers in both adhesive backed and nonadhesive backed format. Regardless of what you choose to use, make absolutely sure that the material will not shed fibers which will end up collecting on your primary and secondary mirror or on the inside of your objective and focus tube. Also, it must not come un-adhered from the inside walls of the OTA. This means the adhesive must be temperature stable for your given climate range.

Note: When I used these cloth type of materials, after the adhesive had sufficiently cured (minimum of 48 hours) - I then vacuumed the inside and finally rolled the entire inside of the OTA with a lint roller to pick up any loose fibers. Whether you use spray paint or cloth, always allow at least 48 hours before reinstalling the optics in order to allow the paint and adhesive to "outgas" - to expel any harmful gasses which may be given off during the curing process.

Rather than rehash what has already been printed, the

following are a few sources of information on materials and procedures using "felt type" or velvet materials.

One of the most widely praised and used materials is a velvet like paper backed material from ProtoStar:

http://www.fpi-protostar.com/flocked.htm

Another good source is McMaster-Carr item #88015K33 at:

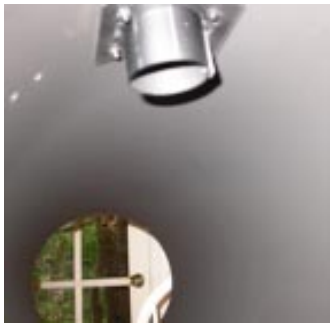
http://www.mcmaster.com/

A nice description of the procedure can be found at:

http://home.earthlink.net/~flyj/velvproc.html

I have tried both the felt (available in squares at WalMart) and the velvet. While both offered improvements, I still noticed occasional loose fibers finding their way to my primary. I decided to search for an alternative.

The goal was to turn the OTA into a very efficient and selective light trap which would bring to focus that which it was pointed at and reduce or eliminate any extraneous light which may enter the OTA. As you can see in the picture, the stock SN10 OTA really was not very dark inside.



I chose to use medium density open cell poly urethane foam which was available in six foot widths from a roll to what ever length I needed. The foam was dark gray and the thousands of tiny cells each act as a tiny light trap once they were sprayed with Krylon Ultra Flat Black paint.

Here is what the inside of the OTA looked like after the treatment. This picture was taken at the same time of day in sunlight with a camera flash. As you can see, there is quite a difference. Another camera shot of the dramatic difference in a different type of OTA - a LX200 can be seen at:

http://www.bbcl03736.pwp.blueyonder.co.uk/Flocking.htm

Read The Entire Procedure Before You Begin. Entire Process Takes About Two Hours - But The Rewards Are Worth It - Sharper / Clearer Images.

Tip: Plan ahead. Since you will be disassembling the OTA, now is a good time to plan on any other accessories you may want to mount to the or changing a focuser, etc.

What you will need:

- ❑ Flocking material of your choice (I used 1/4" thick open cell dense foam)
- ❑ Elmer's Ultimate Adhesive- 8 fl. oz.
- ❑ Disposable paint brush & container
- ❑ Single edge razor blade or razor knife
- ❑ 1" wide masking tape
- ❑ Yardstick
- ❑ 36" x 48" sheet of black 1/8" architect's board
- ❑ Brown shipping paper
- ❑ Krylon Ultra Flat Black Spray Paint - 3 cans
- ❑ Krylon Low Odor Clear Matte - #7120
- ❑ Denatured alcohol and lint free rag.
- ❑ Wallpaper smoothing tool or brush.
- ❑ Water-based sanding sealer.

Tip: I would suggest that you download and read the "Ultimate Collimation" document in its entirety before proceeding as you will have to collimate your scope when finished with this project.

Before starting tape and mark all of the indexing marks for correct replacement of the corrector and primary cells when finished. This procedure is detailed in the Ultimate Collimation Guide (UCG).

After establishing your index guides, remove the four socket screws holding on the corrector cell and set it aside in a safe place. Drape a lint free cloth or clean plastic bag over it to prevent any contaminants from settling on the secondary or the corrector.

Repeat the indexing and removal procedure for the primary cell.

Remove the four screws securing the focuser and set it aside. On the inside of the OTA is a rectangular flexible plastic gasket under the focuser held on by the four screws and small black nuts. Keep the focuser and all associated parts, screws and nuts together. Large reusable baggies make good temporary storage devices.

Remove the two nuts on the inside of the OTA securing the finder scope. Bag these items and set aside.

Cover the focuser opening and all screw / bolt holes with

the masking tape. Press the tape down tightly around the edges of all openings. This will prevent adhesive from oozing out onto the outside finish of the OTA.

After you have all holes and openings taped off with the masking tape, carefully wrap a layer of tape around the outside of both ends of the OTA. Keep the edge of the tape flush with the edge of the OTA. Now wrap the entire outside of the OTA with the brown packaging paper to protect the painted finish of the OTA. You could also use sheets of copy paper, cut up brown paper bags or similar material.

Carefully apply a layer of the 1" masking tape around the inside of the OTA at each end - keeping the tape flush with the edge of the OTA. This will keep the last inch on each end of the inside of the OTA clean and smooth for remounting the corrector and the primary cells.

In describing the application of the flocking material, I am referring to my choice of the 1/4" foam rubber. If you are using a different material, follow the instructions which came with the material or refer to these instructions as a guide. You may also want to consult the information at:

http://home.earthlink.net/~flyj/velvproc.html

Measure the outside circumference of your OTA. Measure the length of the OTA and subtract 2" from that measurement. Cut your flocking material to these dimensions. Make sure the edges are square to each other. By cutting the one dimension 2" shorter than the length of the OTA, the material's edges should line up flush with the inside edges of the tape you applied to the ends of the inside of the OTA. Place the material inside the OTA for a "test fit". You should have some overlap due to the difference between the inside and outside circumference measurements of the OTA. Do NOT trim at this time.

Remove the material and wipe down the inside of the OTA using the rag and denatured alcohol. Allow to dry.

Use the yard stick or suitable straight edge to mark a guide line the length of the inside of the OTA so that it is square with (perpendicular) to the ends of the OTA. You can line the straight edge with the matching screw holes for the corrector / primary bolts at each end of the OTA.

Pour the adhesive into a shallow disposable container and using the disposable brush, apply on a liberal coat of adhesive on the inside of the OTA over the entire length and 1/4 of the way around the inside of the OTA. Apply and even coat completely covering the surface but not so much as to allow it to run.

Roll the foam rubber into a tight roll and insert it into the OTA using the line you just marked and the edges of the masking tape as guides.

Tip: Depending on the length of your OTA, a second pair of hands at the opposite end of the tube can make this process a lot easier.

Carefully and slowly unroll the foam onto the adhesive covered surface of the inside of the OTA. Firmly press it in place and smooth it as you go. When you reach the edge of the adhesive, rotate the OTA and apply more adhesive for another 1/4 of the way around the inside of the OTA. Continue the process till you reach the last quarter making sure that you have adhesive all the way to the leading edge where you started. Stretch or slide the foam inside the tube to keep it aligned with the inside edges of the masking tape.

When you get to the very end, allow the foam to overlap about a half inch, place the straight edge tightly over the now double layer of overlapped foam and using the razor blade or razor knife, make a clean cut the length of the tube through both layers of the foam. You will have one thin strip on top to remove and throw away. Carefully lift up the final edge and peel off the remaining strip - originally your starting edge. Apply a bit more adhesive if needed and press the two edges firmly into the adhesive making sure they butt together. You should now have an almost invisible seam.

Carefully smooth the entire inside surface of the OTA using the wallpaper brush applying even and firm pressure.

Set the entire assembly aside to dry for a minimum of twelve hours.

Baffles....

This may indeed be overkill but it's cheap, easy and certainly can't hurt anything. It also makes the OTA a little more rigid. The baffle rings combined with the foam lining helped to dampen the entire OTA assembly.

The baffle rings will have to be custom fit to your OTA dependent upon its diameter and the type of flocking material you used. My example is with a SN10, you can substitute the measurements needed to match your OTA.

Since the inside diameter of the OTA is approximately 11.9 inches and the foam is 1/4" thick, the new inside diameter is approximately 11.4". Since I wanted the rings to fit snug and "seat" themselves within the foam, I had them cut with an outside diameter of 11-3/4". This allowed them to be press fitted into the OTA and form their own "grooves" within the foam.

Since my primary mirror had a diameter of 10", I had the rings cut with an inside diameter of 10.5 inches which gave

a 1/4" clearance around the inside of the OTA.

After determining the size of the rings you need for your particular OTA, cut a pattern out of stiff cardboard to test for fit. You want a snug fit but not so tight that you have to bend the rings to get them in place or scrape off the flocking material as you try to get them into place.

Once you are satisfied with your pattern and dimensions, cut six rings from the sheet of 1/8" architects board.

Tip: The architects's board is very stiff and may be hard to cut in good clean rings. I took my sheet of board and dimensions to a local framing shop where they cut mattes for pictures. They had a machine to cut perfectly clean circles and cut all six rings for $6.00.

Once you get the rings cut - I used six - you may want to "buff" them gently over the edges with some very fine sandpaper or even an emery board to put a final smooth edge on all edges. Then give each ring two even coats of the water based sanding sealer. Let each coat dry completely - approximately two hours - and then spray each one with a coat of the Krylon Ultra Flat Black paint. Let dry for at least an hour.

Now make a template of how you want to space them out within the OTA. I mounted the first one 1.5" behind the focuser and the last one 1.5" in front of the primary. Take the primary cell and measure the distance from the mounting screw hole in the grey ring to the top edge of the mirror. Using the screw holes in the OTA, transfer this measurement so you know where to mount the last ring. I spaced the remaining four rings equally between the first and the last.

Once you get the measurements and spacing you want, stand the OTA on the primary end and insert the third ring into the OTA and work it into place.

Tip: I used a metal yard stick to tap the rings into place. If the ring was to be twenty inches into the tube, I clamped two small blocks of wood to the yardstick at the twenty inch mark using a small c-clamp. I then just moved the yard stick around the circumference of the tube using it to tap the ring into place until the wood blocks were stopped by the edge of the OTA. Once in place, measure for the next ring, adjust the wood blocks to the right position and repeat the process.

Once in place, apply a thin bead of the adhesive around the ring where it contacts the foam against the inside edge of the OTA. Do this on both sides of the ring.

Now repeat the process for the second ring and then the first (closest to the focuser). When finished, turn the OTA over so it is now standing on the corrector cell end and repeat the process beginning with the fourth ring, then the fifth and finally the sixth ring (nearest the primary end). Allow the OTA assembly to dry overnight.

Tip: Now is a good time to perform that clipectomy to remove those spike inducing mirror clips by siliconing the mirror to the primary cell. I used 9 globs of silicone, set the mirror in the cell, installed the clips using round toothpicks to "wedge" shim the mirror while the silicone was curing. Now is the time to verify the center mark is properly placed . Read the "Ultimate Collimation" guide before doing this as you will want to do the two process in tandem.

You can read more on this procedure at Paul LeFevre"s web site:

www.lefevre.darkhorizons.org/lxd55/clipectomy.htm

If you perform this procedure, your mirror will have no overhanging obstructions and will appear to float in the end of the OTA when you look in from the corrector end.

Before painting the inside of the OTA with the Ultra Flat Black paint, you want to mount all of your accessories back onto the tube. This includes the finder scope, focuser and anything else which has bolts passing through to the inside of the OTA.

Tip: Anywhere a nut was originally used on the inside of the OTA to hold a bolt or screw, I replaced them with flush fitting T-nuts. You can see pictures here of the 3/4" long t-nuts used to hold the focuser in place. Here you can see the t-nuts being used to hold the focus gasket in place and the two nuts for the finder scope mount. This is what it looked like before the Krylon Ultra Flat Black. A close-up view of the nuts shows that you do NOT want the screws to protrude beyond the bottom of the nut. This way there is nothing protruding into the light path and offering surfaces for stray light to reflect off of.

Now come the finishing touches. Depending on the size of

your OTA, the painting of the inside can be a little tricky. The goal is to get a nice even solid coat of Krylon Ultra Flat Black over the entire inside surface of the OTA and baffles.

If you are mounting the stock focuser back onto the scope, only mount the base - remove the focus tube, and pinion / knob assembly. Stuff some paper towels down the focuser or mask it off with masking tape to keep the paint from drifting up the focuser tube and out of the OTA.

Remove the one inch strip of masking tape that you allied to the inside of the OTA at each end. This should leave you a clean smooth surface at each end of the OTA. Wipe this down with alcohol and allow to dry.

Reach in the tube and begin spraying. Keep the can and nozzle moving so you don't get pools of paint. You probably have to do this from each end of the OTA. It may take several coats to make the inside totally black. Wait at least 15 minutes between each coat. After four or five coats, I then seal one end of the OTA with newspaper and masking tape, stand the tube on that end and then spray into the tube so that the black mist "hangs" in the tube and settles into all the nooks and crannies. After several repeats of this process, I remove the newspaper form the sealed end and seal the opposite end. Flip the tube over and repeat the misting process now from the other end of the OTA. This allows you to evenly cover both sides of all the baffles. When finished, give a final coat with the Krylon Clear Matte finish to "fix" the paint and prevent any flaking.

Once you are satisfied with the "blackness" of your OTA, set it aside in a well ventilated area and allow it dry for a minimum of forty-eight hours. This allows everything to dry and any lingering chemicals to outgas and clear out of the tube.

As you can see the result is a very dark OTA - even when a close-up flash is used. This increased darkness will result in higher contrast views when trying to pull out that last bit of detail in those faint fuzzies. It especially helps in light viewing areas.

The pictures shows a view inside of my OTA when taken with direct lighting and close up flash. As you can see, the difference between a treated OTA and stock OTA can be quite dramatic.

If you own a refractor, you can also reap the benefits of OTA flocking. If you remove the front objective cell and the rear focuser cell, you will notice that the OTA has several circular baffles already installed. I covered the inside of my AR6 from the first baffle to the end of the OTA at the objective end and from the last baffle to the end of the OTA at the focuser end. I used the self adhesive backed black velvet - product #88015K33 - available at:

http://www.mcmaster.com/

This can be a bit tricky to work with as it has a tendency to want to curl around and stick to itself. You may find it easier to install it in strips. I would also recommend that you flock the inside of the dew shield

I also replaced the three bolts on the inside of the OTA which actually are in the light path, with flush mounting t-nuts as I described in the SN10 process. These are easy to get to by removing the entire front lens assembly from the front of the OTA.

Depending upon the size of your dew shield, I also had rings cut out of the same type of architects's board, covered them with the adhesive velvet and baffled the dew shield.

Note: If you use any type of cloth such as felt or velvet, roll it firmly with a clothing lint roller after installing to insure that you remove any loose fibers and reduce the chance of loose fibers settling on your focuser or lens.

Before applying the flocking material, since you have the front objective and focuser removed, I would recommend spraying the inside of the OTA with Ultra Flat Black.

You will notice that if you look into the objective end of the OTA after it is reassembled, it will be very black with the

exception of a shiny ring visible at the very end of the scope. This is the front (end) edge of the focus tube. I removed the focus tube and sprayed the last one inch of the focuser tube with Ultra Flat Black. Use making tape and the brown wrapping paper to mask off that part of the focuser beyond the focus rack.

As you can see in the picture, the ring is no longer visible - one less reflection to contend with.

Replace The Screws....

On the SN series of scopes there are many small "dome head" allen screws which can become a real problem in removing in that the very small hex sockets are hard to get a grip and very easy to strip. Take one of the eight screws that hold the corrector and primary cells to the tube - there are four for each end of the scope - down to your local hardware store and get eight replacements just slightly longer and made of hardened steel or stainless steel. Get eight matching small washers.

When you remount the corrector and primary cells, replace the stock screws with these new ones. They will have larger heads and sockets and be a lot easier to tighten and remove should you have to open the OTA again for further work.

Collimation Screws....

If you've tried collimating the secondary mirror, you already know how easy it is to have the small hex wrench slip out of the shallow socket or strip the socket on the three stock secondary adjustment screws. Make sure all three of the stock screws are "snug" and then remove one completely. Again, make a trip to your local hardware store and buy three new screws of the same thread size (I bought them 1/4" longer) and made of hardened steel or stainless steel. Replace each of the stock screws one at a time. Never remove more than one screw at a time and make sure it is snug before you remove the next one.

Mike Gray has offered another solution to make it easier to adjust the secondary alignment screws: I found everything I needed at Lowe's Hardware store but I'm sure any decent cabinet or hardware store will have what you need in the fastener section.

If you can find them, 2" 8-32 screws with a 1/2" head are a perfect replacement. The heads will just barely clear the top rim of the secondary holder and allow you to finger adjust the secondary without interfering with the dust cover.

If you can't find the screws in the correct size you can buy 1/2" female threaded knob heads and a threaded 3" 8-32 rod and use a Dremel to cut them down to size. I used the Dremel to grind the end of the screw smooth so you get a nice even contact with the secondary mirror holder. I don't know how much difference it makes but it only took a couple of minutes so why not.

Courtesy of Mike Gray

If you look closely at the three large primary mirror adjustment screws on the rear cell in the picture, you will see that there is a white nylon washer under each of them. I found that this along with a very small dab of white lithium grease or Lubriplate resulted in much easier and smoother adjustments of these knobs. The washers also prevented the paint finish on the primary cell from being ground away by the knobs.

Final - exact - adjustments are always made with the three smaller "locking" screws. When you are in the process of collimating your scope, very slight adjustments on these screws is all that should be needed. Even smaller adjustments are needed for the secondary adjustment screws. Do not over adjust or overtighten. The differences between a well collimated scope and one that is even slightly out of adjustment can be dramatic. It can mean the difference between seeing the "ring" around the planet Saturn or the individual rings and their divisions.

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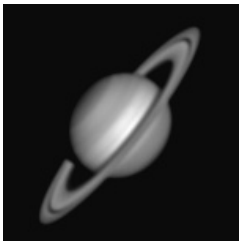


http://perso.club-internet.fr/legault/collim.html

Adding A Fan....

Much discussion has been made about the pros and cons of adding a fan to the rear cell of the OTA vs. the side position or somewhere else. My needs were to simply accelerate the temperature equalization process without compromising the integrity of the OTA both structurally and visually. My solution was to mount the fan in the rear cell behind the primary. This allows me to blow filtered air into the tube to equalize the primary or to pull air out of the tube to eliminate any boundary layers of cool air. This mod is easily undone so you can put your scope back in original condition should the need arise.

I used a 24 volt DC low profile reversible box fan. The 24 volt fan allows me to choose 6v, 9v or 12v power taps from my power supply to vary the speed of the fan as needed. Select the thinnest fan you can find so that it will not protrude beyond the rear of the primary cell when you are finished. This will allow you to still be able to stand the OTA on the primary end should you need to store it.

What you will need:

- ❑ Shallow box type "muffin" fan - 1" smaller than the diameter of the primary cell opening.
- ❑ Wire guard or "cage" for fan.
- ❑ 4 - 1" 8-32 screws, with matching nuts.
- ❑ 4 - split washers for above screws.
- ❑ 8 - washers for above.
- ❑ Hot glue gun and glue.
- ❑ Razor knife.
- ❑ Compass - geometry tool for drawing circles.
- ❑ Miniature double pole - double throw switch.
- ❑ Polarized panel mount power connector - like the power jack on the LXD55 control panel.
- ❑ Hook up wire.
- ❑ 2 pieces 12"x12"x1/8" architect's board.
- ❑ 1 piece 12"x12" DynaMat or equivalent sound deaden ing (available at Car Stereo shops)
- ❑ Water based sanding sealer.
- ❑ Fine steel wool or sand paper.
- ❑ Hyper Allergenic Furnace Filter.
- ❑ Krylon Ultra Flat Black Spray Paint.
- ❑ Silicone Adhesive.

Begin by marking the position and indexing the rear primary cell and removing it from the OTA. Mark position indexing marks around the cell and then carefully remove the primary mirror from the cell and set aside in a very safe protected place.

Tip: If you have not yet done so, make sure the three collimating bolts protruding from the primary mirror holder are tight. Apply some Locktite, epoxy, a lock nut - whatever your choice to keep them from coming loose in the future.

Carefully pry off the plastic cosmetic disc that covers the opening in the cell. Use this as a template and cut a disc out of the architects's board with a diameter one inch bigger than the template. Center the fan on this larger disc and trace the outline of the fan. Mark the four mounting holes of the fan. Place a ruler lined up on the diagonal holes and draw two intersecting diagonal lines between the two pairs of marks. The intersection of the two lines should be the center of the disc. Use a compass to draw a circle with its circumference just outside of the four mounting hole locations. Cut out this ring. When finished, the fan should just fit inside of this ring you have just cut out. Place this ring on the inside of the primary cell and test for fit. It should fit flush against the metal surface of the cell. You may have to cut out some indentations to fit around the molded screw housings / piers on the metal ring.

Using the plastic disc again, cut out another disc the same size as the plastic disc. Again, position the fan centered on this disc and mark the four mounting holes to find the center of the disc. Using the center point and the compass, draw a circle centered on this disc that is the same size as the diameter of the fan opening - not the square frame of the fan but the actual round fan shroud. Cover one side of this disc with the DynaMat "vibration dampening material. Trim it flush to the edge of the disc and the opening for the fan. Drill holes through the disc assembly at the four corners of the fan to line up with the mounting holes of the fan.

Give each of these discs a minimum of two coats of sanding sealer and allow to dry completely between each coat. Make sure you cover and seal the edges of the discs. Lightly "buff" the discs with the fine steel wool and brush or wipe them off.

Take the larger disc and check positioning within the cell one more time. Place six dobs of silicone around the inside of the metal rear cell and press the larger of the two discs into place. Make sure it is pressed down evenly to spread out the silicone and that the opening is centered in the cell. Allow this assembly to dry.

Now, mount the fan to the

other ring with the screws, washers and locknuts. The side of the disc with the DynaMat treatment will face the outside of the primary cell. The fan has mounting holes on both sides. Depending on what side you use to mount it, the fan will either protrude further into the OTA or protrude on the outside of the OTA. Choose which ever you prefer. If you have the fan mounted so that it protrudes further into the OTA - make sure to check for clearance with the metal ring of the primary holder and the actual back of the mirror. You must have clearance between the fan housing and the primary holder and mirror to allow for collimation adjustments. Once you've determined the orientation and mounting positioning, put a bead of silicone around the ring holding the fan on the side of the DynaMat and position and glue this to the inside side of the already previously mounted ring. Check for centering and allow to dry.

You now have in order from the outside to the inside: The metal primary ring - the first cut ring - a layer of Dynamat - and finally the smaller ring with fan.

The mounting positions of the switch and power jack is up to you. You can check the picture for ideas - I mounted them on each side of the fan - centered in the space. Begin by drilling the appropriate size hole for the switch and plug in the mounting positions you choose. Apply a coat of sanding sealer around the hole and the edges of the hole - allow to dry. Paint as indicated below.

Tip: At this point with the fan mounted and the holes drilled for the switches, I masked off the gray primary cell and the fan opening and sprayed the fan assembly with a crinkle finish satin black paint. I also feathered in some of the edges with paintable latex caulk to give a more "factory" appearance before painting.

Mount the switch and power jack in their respective holes. Flip the cell over and wire from the back side. Use the hot glue to hold down the wires against the cell. When finished, mask off the gray area of the rear cell and the fan opening and spray the inside fan assembly with Ultra Flat Black spray paint.

Plug the power into the fan and test for operation. I used a double pole - center off - switch to allow me to reverse direction of the fan and airflow just by flipping the switch to the other position. Allow everything to dry, remount the primary assembly into the cell.

Tip: Place a thin nylon washer under each of the large collimation knobs to make them smoother and easier to adjust and to protect the paint of the cell. I cut out a square or circle - depending on your fan configuration - of hyper-allergenic furnace filter material to place over the outside opening of the fan. It should "sandwich" between the fan grill and the fan. I used plastic knurled nylon screws to hold the grill to the fan which allowed fast changing of the filters as needed to keep any unfiltered air from entering the OTA from the primary end.

If all is working properly, remount the primary into the cell. Mount the cell back into the OTA and collimate.

Tip: Focus tube must be open for air to flow.

Focus Enhancements....

By far, I found the most frustrating aspect of viewing being that of trying to reach that absolute perfect "sweet spot" of fine focus. While the focusers on the LXD series of scopes are not the best... they are certainly serviceable. However, no matter how much I adjusted, shimmed, aligned, etc.... I still had to touch the focus knobs to focus which resulted in vibrations in the OTA which made the image jiggle which prevented me from quickly reaching my objective of a sharp focused image.

At the very least, the next thing to do to help your focus problems after you have aligned and adjusted is to switch those ugly small knobs for some larger easier to grip knobs.

There are many out there to choose from but the two that I like are the new rubber grip knobs available from Orion at $19.95 / pair (part #07217) for my smaller ST80 guide scope available at:

http://www.telescope.com

These knobs will fit most focus shafts that have knobs mounted from the ends with screws. The knurled rubber grip make these very easy to handle on frosty nights.

If the knobs on your focuser do not having a mounting screw on the end of the shafts, you may want to consider ones which mount with a set screw to lock them to the

shaft. I am currently using the large 2" knurled edge 5-hole aluminum knobs made by James Grigar at AstroSky:

http://astrosky.homestead.com/Astrosky.html

James sells these knobs either as singles or in pairs (about $27.00). They are very easy to grip and aid in fine focus control as well as adding to the appearance of your rig.

Note: James has indicated that he will be shutting down his AstroSky operations after February of '04. I do not know how long he will have these available. Sorry to see him go... his piers and accessories were top shelf quality and he was a pleasure to work with.

Eliminate The Shakes....

The best investment I found that gave immediate viewing enhancement to my scopes was the addition of an electric focuser. This gave me push button controlled motorized focusing which eliminated the need of having to touch the focuser or the OTA. Images now "snapped" into focus without any of the associated tube shakes.

On both my SN10 and AR6 I mounted a JMI MotoFocus available from:

http://www.jimsmobile.com/

JMI has been well recognized for replacement focusers on scopes of all configurations and manufacturers. They are a simple "bolt-on" accessory which are built to last and easy to use.

The unit comes with a remote handbox which connects to the focuser via a coiled cord and gives forward and reverse operation. The handbox has two buttons - one for each direction and knob for infinitely variable speed control. Operation is smooth, precise and quiet. Suggested retail price of $129.95.

For the Do-It-Yourself enthusiasts, there is an option from Meade - the 1240 focuser for the DS series - which can be adapted to work on the LXD55 series. It comes with a remote handbox which offers four speeds of control in either direction. Although it is noisier than the JMI option, it has the ability to plug into the AUX port of the LXD55 control panel and can be accessed from the AutoStar - by holding down the MODE button. The screen will indicate focus and the up and down arrows will control the focuser. It offers four speeds of control by using the 1 - 4 keys to choose speed. These can be found for around $59.00.

The easiest way to adapt this focuser is to obtain the back focus plate from one of the older DS series of scopes or from Meade parts. If you have this plate, it can be glued to the existing focus retaining plate of the LXD55 focusers and then bolt right on with some slight adjustments. If you can not find one of these plates, a suitable mounting plate could be fashioned from scrap plastic.

Adapting The Meade 1240 Focuser....

To install the Meade 1240 electric focuser on the LXD55 – 4 speeds / dual motion / AutoStar 497 controllable / plugs into the AUX port on the LXD55 control panel.

What you need:

- ❑ 1240 focuser
- ❑ 3/8" shrink tubing
- ❑ Hair dryer or heat gun
- ❑ Superglue
- ❑ Medium sandpaper
- ❑ 5/16" drill bit
- ❑ Brass washer
- ❑ Two rubber o rings
- ❑ Pinion back from a DS127 scope (Meade sent me one at no charge).

READ ALL THE DIRECTIONS FROM THE 1240 FOCUSER FIRST BEFORE YOU START.

The pinion shaft on the LXD series is slightly larger and not as long as the one for the DS series (which the 1240 is designed for). Remove the four screws holding the retaining plate (u shaped metal bracket holding in the pinion shaft) and the LXD pinion. Unscrew one of the knobs from the shaft – they are very tight. Find the black threaded collar assembly from the focuser kit. Remove the adjustment nut and all parts from the black threaded collar designed to fit over the shaft. Cut the small "nipple" from the threaded end of the threaded clutch collar – sand the end smooth. Using the 5/16" drill, very carefully enlarge the opening in the collar till it fits over the end of the LXD shaft. – you want this as snug as you can get it. You might start out with a smaller drill or even a Dremel tool. Place the collar only over the shaft and replace the knob you just removed. Squirt some super glue on the large flange of the collar and carefully center it and glue to the inside of the knob – BE CAREFUL THAT YOU DO NOT GET GLUE ON THE THREADS. Let it dry completely and then again unscrew the knob and remove your newly created knob clutch assembly.

Take the back plate from the DS127 and sand it down almost to the little holes drilled vertically through it. The standoff of the DS127 mount was greater than that of the LXD series. Without sanding it down, it will not fit close enough to the pinion shaft to engage the gears. Once you have it sanded down, turn to the metal plate you removed from the LXD focuser. Sand the black paint off of it. Center the metal LXD bracket onto the DS127 bracket (the one you just sanded), it is longer than the metal bracket. Orientate the the two brackets so one end is flush – the other end will have the plastic DS127 bracket overhanging the metal bracket. With a pencil mark the four small mounting screws holes of the metal LXD bracket onto the plastic DS127 bracket. Drill out the holes on the plastic bracket. The holes MUST be drilled out enough to allow the heads of the LXDscrews to pass through them.

Making sure both surfaces are clean, superglue the plastic bracket onto the metal bracket – making sure the holes of the metal bracket are CENTERED in the holes of the plastic bracket. Don't worry if you make the holes in the plastic DS127 bracket too large – you won't see them anyway. Put aside to dry.

Now assemble the clutch pinion assembly. Take the knob with the clutch shaft which you just glued together. Place an o-ring over the shaft and slide it up to the flange (I did not get the size – I just went to the hardware store and bought two that fit snug over the clutch shaft). Next the nylon gear, then another o-ring, a brass washer (make sure the washer diameter is smaller than the teeth of the nylon gear), and finally the locking nut. Repeating the order:

knob, clutch flange, o-ring, nylon gear, o-ring, brass washer, nut. This assembly will slide back over the pinion shaft.

Take a piece of shrink tubing and cut it to fit over the end of the pinion shaft with the knob removed. You want it to cover only the large end portion of the shaft. Leave about a 1/16 inch gap of metal showing at the inside flange – do not cover all the way to the center smaller shaft. Leave just enough hanging over the end with threads so that it "wraps" over the shoulder of the shaft when you heat it up with the hair dryer or heat gun. Now twist the knob and clutch assembly back onto the shaft. It will be tight and it will not go far enough to allow you to thread the knob back on. This will be a "friction" fit for now. Position the pinion shaft back in place and remount the retaining plate assembly using the 4 original screws. Do not tighten the 4 screws too tightly – they control the ease of movement of the focusing mechanism. Tighten all 4 equally and test the feel of the focuser. It should be firm but easily to turn with little drag.

On the back of the motor are two "rails". One is a "positioning rail, the other has brass threaded inserts. File down or use a Dremel tool to grind off the ends of the rails – up to the brass threads. This is to make sure you have clearance for the screw heads holding on the bracket. Position the motor with the cord toward the corrector plate and the gear engaging the gear you installed on the pinion shaft. Mount the motor to the DS127 plate as indicated in the directions to the 1240. The cord of the motor will be facing the front (corrector plate) end of the scope. The gear will be towards the primary mirror end. Loosely insert the small allen screws from the 1240 kit till you engage the threads – leave it loose for now – until you get final positioning. You will have to move the knob/clutch assembly in or out ton the shaft till the two gears match up and mesh. Once you get them to match up – tighten down the allen screws so the motor is tight.

If all is OK… when you power up the focuser the two gears will be turning together. Tighten the large nut on the clutch assembly until there is enough friction for the focuser to move the focus tube and yet just loose enough that you can still turn the focuser by hand.

My clutch assembly was tight enough that this is where I finished. You may have to "fiddle" with the alignment of

the collar on the shaft until it is in line with the shaft and not "wobbling" as it rotates. If it is not tight enough at this point, a shot of super glue between the end of the shaft assembly and the pinion shaft should fix it.

My assembly worked smoothly and the control feature of the AutoStar is an added bonus.

Note: Because of the nature of movement of the scope on the equatorial mount, there is not enough cord to go from the motor to the control panel AUX port. It reaches in home position but as you slew, you will rip it from the socket. I cut the cord and spliced in a 8 " length of 4 conductor coiled cord (like a radar detector cord). I run the straight wire from the motor – to the cradle rings – down under the scope and then let the coiled wire run from there to the AUX jack. This gives plenty of play for slewing and stretching.

LXD55 SN 10" Focuser Modification...

This modification is designed to solve the problem of fine focus adjustment on the SN10 stock focuser. The result is a vast improvement over the stock focuser. The focuser will feel firm yet smooth. You can still perform macro movement with the remaining original knob plus you will get 6:1 fine tuning with the new knob making focusing so much easier.

Materials needed:

- ❑ 1 x Vernier 6:1 Reduction drive (also called a ball drive)
- ❑ 1 x ¼" diameter brass rod
- ❑ 1 x Circuit board (or similar material) 70mm x 70mm
- ❑ 2 x small bolts and nuts (1/8" or smaller)
- ❑ 2 x 4g x 10mm self tapping screws
- ❑ 1 x knob suitable for ¼" shaft

Tools

- ❑ Screwdrivers
- ❑ Coping saw
- ❑ Drill and bits (hand or cordless)
- ❑ Pliers

Note: The reduction drive (pictured) is designed to allow fine tuning of air variable capacitors in old radio sets. They can be difficult to find. I eventually got mine from Surplus Sales of Nebraska. It has a ¼" input shaft and a ¼" output collar.

The brass rod is used to make a ¼" diameter brass collar that screws onto the existing focuser shaft in place of one of the knobs. I had this done at a local engineering shop. I'm sure it wouldn't be too hard to do yourself if you have the equipment. The finished collar needs to be 7mm to 8 mm in length.

Procedure:

1. Remove the corrector plate from the OTA taking the usual precautions (this procedure should be described elsewhere).

2. Remove the focuser from the OTA by removing the four nuts inside the OTA that secure the focuser. Be VERY careful not to drop them onto the primary mirror. For this reason it may be better to perform this operation with the OTA on its side. Once the nuts are off, remove the inner focuser plate and the bolts and withdraw the focuser.

3. Remove the four screws securing the tension adjustment plate. Remove the plate and the shaft.

4. Remove one of the focuser knobs by turning it counter clockwise while holding the shaft still.

5. At this point, you can either make up the brass collar if you have the tapping equipment or take the shaft and the rod to someone who can do it for you.

6. Screw the brass collar onto the focuser shaft and tighten it.

7. Reattach the focuser shaft onto the focuser. You may want to add a little extra grease to the worm drive. Adjust the tension plate screws so that the focuser tube moves smoothly and does not slip.

8. Attach the reduction drive to the brass collar. Secure it with the grub screws supplied. The drive should be located so that the circuit board will fit flush against the base of the focuser and underneath to two attachment lugs on the drive.

9. Mark out the diameter of the outer chrome case of the drive onto one side of the circuit board. Mark out the shape according to fig 1.

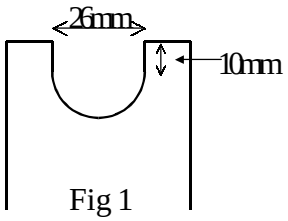
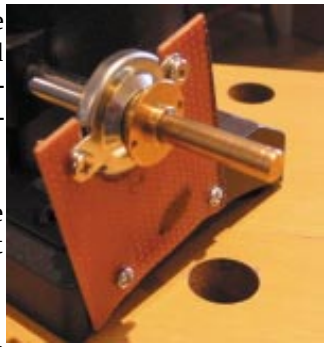


Fig 1

10. Cut out the semicircular shape with a coping saw. The board should fit snugly around the outer case of the drive, allowing enough material to attach the screws to.



11. Mark the position of the attachment lugs on the circuit board. Drill holes for the bolts.

12. With the board in position, mark the curve of the focuser base onto the circuit board.

13. Cut the circuit board to match the curve of the focuser base.

14. Attach the board onto the drive with the small bolts.

15. Drill two holes (just smaller than the self tappers) through the circuit board and into the side of the focuser base.

16. Secure the board to the base with the self tappers.

17. Put the new knob on the shaft of the drive and secure it with its grub screw.

18. Reattach the focuser to the OTA.

19. Reattach the corrector plate to the OTA.

Note: For the small bolts, I used some computer nuts and bolts that I had spare. There were smaller than the 1/8" bolts that I bought for the job, but I think they worked better.

You may want to smooth the corners of the circuit board to remove the sharp edges and improve the look of it a little. I colored the board to help with aesthetics.

As an alternative to the ¼" brass collar, I considered either buying a reduction drive with a larger coupling, or possibly getting the shaft machined down to ¼". However, both of these ideas would not have lined up the drive with the side of the focuser base, making it more difficult to attach.

Article by Tony Hitchcock.
Original Idea By John Barclay

Focuser Replacement....

With the addition of the MotoFocus to my scope setup I had achieved smooth fine focus without the jitters or shakes - a welcomed improvement. The only problem now was image shift - the movement of the image within the FOV due to minute lateral movements of the focus tube within the focuser as you rack in and out. I decided it was time to replace that stock focuser with an after market zero shift focuser.

I considered several different manufacturers and designs of focusers which I have listed below - some conventional and some non-conventional.

Helical focusers give fine adjustments with no shift, but would be hard to motorize. I did not want to give up that luxury.

An example of an inexpensive helical focuser would be the Orion part #13025 for $44.95 at:

http://www.telescope.com

Another slightly unconventional type of focuser is the new product from Donald Clement. This open frame type of focuser claims to have zero shift and exceptional weight capacity which may be handy for those of you wanting to use full size full featured digital, film and palm type cameras. It has provisions for being motorized with the addition of the motorized add on and software from Robo-Focus. Their products can be added to many different focusers and controlled via laptop computer. You can see more details about their products and compatibilities at:

http://www.clementfocuser.compages/1/index.htm

and at:

http://www.homedome.com/robofoc1.htm

Out of the many focusers I researched and several which I was given the opportunity to experiment with, I narrowed it down to the following four units.

Williams Optics seems me to be the hands down best bang for the buck when it comes to an affordable, well built, smooth zero-shift Crayford focuser. Their two inch model is built very well, has a fine finish, large easy to handle rubber gripped focus knobs and is buttery smooth. The travel distance is rather short and the

focuser is low profile which requires the addition of an extension tube with most eyepieces.

This focuser is available at most of the better retailers - some off which are listed on the last page of this guide.

www.william-optics.com/accessory/2inchntsct.htm

The focuser is not motorized and it would take some ingenuity to fit a commercially available motor upgrade to it. Williams Optics has indicated that they may have a collimatable base available for this unit in the future. Nonetheless this is a fine piece of work and at $139.95 would make an excellent upgrade to any Newtonian type scope.

Another choice for the SN series of scopes would be the MoonLite Crayford focuser. These are available in several styles which include different colored bodies as well as right or left handed dual rate fine focus control. There are also models with easy to change filter holders and multiple filter slides. Prices start at about $265.00 for the basic focuser and they have accessories for the LXD55 series of scopes that include mounting spacers, filter holders and others.

Again, at the present time there is not a motorized version of this focuser. However, the fine focus will aid in having your targets snap into focus.

Several members of the LXD55Telescope group have given good reviews on this focuser and its operation.

One user has used the MoonLite focuser on his SN6 and reports that the MoonLite does not fit the SN6 focuser hole from stock. The focuser opening had to be made wider by approximately 1mm and the mounting screws do not match the stock mounting holes.

One other caveat is that the MoonLite is such a low profile focuser you will need two extension tubes to reach focus.

Courtesy of Goncalo Carvalho

Another highly appraised focuser is the Starlight Instruments Feathertouch. This focuser is quite simply one of the best looking, best crafted and smoothest focusers I have ever seen. The built in fine focus knob is outstanding and the action is buttery smooth. While Starlight does not have a specific kit to fit the LXD55 series, they have several different configurations for mounting bases which should allow you to fit it to your particular OTA.

While there does not seem to be a website StarLight, their products are available through most of the higher end dealers. More information can be seen at:

http://www.astrofieds.com/docs/feathertouch.htm

They have indicated that they are working on a motorized model and also one with digital readout so that you can duplicate focus position and setup between eyepieces. No firm timetable could be established for these products.

Note: Any of the above focusers will make a welcomed enhancement to your existing OTA. There are others to choose from, but after much research, talking with the various manufacturers and trying some of the focusers, I made my decision based upon my particular needs and how I was going to be using the scope. The motor control was an important factor in that I did not want to have to be touching the OTA and I felt I could get a finer focus with the motorized unit rather than manually - especially on those sub freezing nights. Do your homework - pick the one that is right for you!

J.M.I. Motorized Crayford...

After much deliberation, I chose the JMI NGF-55DM motorized Crayford zero shift focuser. This focuser is available for the SN8 and SN10 models as a bolt on replacement - no drilling, no cutting. It comes is a standard or deluxe model, motorized / non motorized. The deluxe model includes

rubber gripped wheels and has a lifting capacity of eight pounds vs. six pounds for the standard. The motorized version comes with a clutch mechanism on the left end of the shaft to permit adjustment of manual focus tension. My ONLY criticism of this focuser is that I wish they would have included a second focus knob attached to the clutch end of the shaft.

The people at JMI are friendly and willing to answer your questions. If you have any fears or doubts about which focuser fits your OTA, don't hesitate to contact them. Also check out their MotoFocus motorized adapters which will fit the standard factory focusers on both the SN series Newtonians as well as the AR series of refractors.

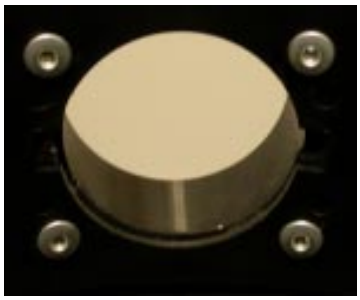
http://www.jimsmobile.com/

When my focuser arrived via UPS, it was packed tightly in fitted foam worthy of a quality piece of precision equipment. The parts are all finished nicely and needed very little adjustment to suit my individual feel of the action.

Mounting the new focuser was a piece of cake. Total time was about twenty minutes with another ten minutes to align it to be perpendicular to the tube. A task made very easy since the base includes four collimating screws to fine adjust the orientation of the focuser.

After removing the front corrector cell as described in previous sections of this guide, you simply remove the four bolts holding the stock focuser in place, and replace it with the base and gasket using the black flush mount beveled screws provided by JMI. I placed the gasket provided by JMI between the base and the OTA and kept the factory plastic gasket for inside the OTA. The fit is perfect with no cutting or extra holes to drill.

Tip: On the inside off the OTA I replaced the standard nuts provided with flush fitting t-nuts as can be seen in this picture. After mounting, take a small paint brush and paint the silver heads of the nuts with flat-black paint. This eliminates any protruding surfaces that may contribute to reflected light.



Once the base is mounted, add the focuser, insert your laser or crosshair sight tube and use the collimating screws in the base in conjunction with tightening the four main mounting screws to adjust the tilt of the focuser so that your crosshair or target strikes your alignment target on the opposite side of the OTA as described in the previously released *Ultimate Collimation Guide*.

Once you satisfied with the alignment, tighten everything down, recheck alignment one more time and then remount the corrector cell.

You can now fine tune the feel of the focuser with the small allen set screw in the back of the focuser to adjust the tension against the focus tube. Manual focus is easily adjusted by tightening or loosening the aluminum knobs at the end of the focus shaft.

Tip: The focuser comes with a cork washer on the large aluminum clutch wheel. I removed the cork, polished the inside surface of both aluminum knobs very smooth with some fine jewelers rouge and then placed a thin teflon or tyvek washer sandwiched between two thin nylon washers between the two knobs. This allowed me to maintain a much smoother and easier feel for manual focus while still maintaining no slipping in the motorized mode.

The handbox comes with two push buttons - one for each direction and a three speed selector switch. Control is positive and precise. Holding down the buttons for 3 seconds in either direction, kicks the motor into a high speed mode.

If You Do Nothing Else - Consider This Enhancement.

Refractor Focusers...

Compared to the number of third party commercial replacement focusers for Newtonians, the number of focusers available for refractors seems a bit lean.

The European based Sky Objectives has a hybrid rack and pinion / Crayford style zero shift focuser at their web site:

http://www.so-nl.nl/RR%20focusers.htm

In addition to focusers, they also offer lens cells, objectives and complete kits. Pricing is given in Euros so you will have to base price on the exchange rate at the time.

Another source of high quality hand crafted products is Burgess Optical. His 200A refractor focuser has been reviewed at Cloudy Nights and is reported to be a very fine addition to any refractor.

www.cloudynights.com/accessories2/burgess.htm

You will have to call Bill and get the details on availability of the focuser and the appropriate adapter plate for your scope.

You may have to wait a bit to get your focuser as Bill has his hands full and is focused on the delivery of his new scope line - but from all reviews and indicators - the wait is worth it.

It's All In The Balance...

One problem that seems to be common to any of the larger refractors is getting it to a comfortable position within the rings. Due to the weight of the larger objective lens cells, the OTA has to be pushed backwards in the mounting rings to reach balance so there is a much longer section of the OTA sticking out at the focuser end than at the objective end. This can lead to some very uncomfortable viewing positions as your targets move higher in the sky.

One way to fix this problem is to add weight to the rear of the OTA - preferably inside the focus cell where the modification will be invisible.

Here is the method I chose. Its cheap, it works, it's removable.

What you will need:

- ❑ #8 lead shot (or sand)
- ❑ Hot glue gun and glue
- ❑ Cotton balls
- ❑ 1" clear vinyl tubing
- ❑ Black vinyl electrical tape

Carefully remove the focus cell from the OTA. Cut a piece of the vinyl tubing just long enough so that you can wrap it around the inside of the OTA. Cut an additional 1/16" off of one end of the tubing.

Take a cotton ball and stuff in one of the tubing. Now fill the end with hot glue. The cotton ball will keep the glue from running inside of the tube and cause it to form a "plug" in the end of the tube.

Fill the tube from the other end with the #8 lead shot (available at most hunting / sporting goods stores). When you are within a 1/2" of filling the tube, stuff another cotton ball in the end and fill this end with glue to seal the shot inside the tube. Form the tube into a ring and hot glue the two ends together. Wrap the ring in black electrical tape and fit it into the end of the OTA. Be sure it is in far enough to clear the flange when reinsert the focus cell. Tack it in place with three or four small dobs of hot glue.

Make another ring as above to fit inside the focus cell.

Make sure it clears the rack and focus tube. The picture shows the ring mounted inside the focus cell of my Orion 120mm f/8.3 refractor - but also works with the AR series of scopes.

By adding two rings to the focus cell and one to the OTA, my scope now balances with the ep much closer to the rings so that most of the scope is now out in front of the rings pointed toward the sky.

Tip: Notice the end of the focus tube is painted flat black to eliminate reflection from the end of the focus tube.

Finders Keepers...

Another welcomed addition to all my scopes is that of an easy to use finder scope. There are many available but one of the most economical and easy to use is the 9x50 RACI (Right Angle Correct Image) finder from Orion. It sells for $79.95 ($61.50 on sale) as part #07212. It mounts on a standard dovetail mount, is easy to adjust and focus, has easily visible crosshairs and has clear wide views.

The dovetails can be obtained from Orion. Or, you can

get them from Scopestuff at a cost of $5.00. You can see the finder here mounted on my Orion 120 as well as my AR6.

Also shown in the pictures are the improved Williams Optics 2" diagonal, Orion deluxe focus knobs and the JMI MotoFocus.

There are variations of these finders available - some with interchangeable eyepieces. These are much easier to use and reach as your scope slews to those sometimes awkward and almost impossible positions.

Another finder that I have mounted on all of my scopes is the red dot reflex finder. These add almost no weight, are low profile and make pointing your scope just that - point and look. They consist of wide field of view lens which has a red dot projected on it from a LED. The brightness is adjustable to suit your viewing conditions. If you can see an object, you simply move the scope till the red dot is on the object - it doesn't get any easier than that.

They are available from Scopestuff for $20.00 plus a standard dovetail base for $5.00.

http://www.scopestuff.com/ss_rdp1.htm

Orion has the EZ-Finder available for $34.95 when not on sale as part #07228. It does not include a dovetail which has to be purchased separately. It will use the same dovetail as the Scopestuff model.

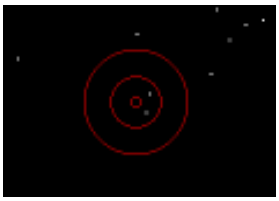
A third option is the Giant Mars Eye Finder which features a selectable red or green dot available from Apogee at:

http://www.apogeeinc.com/scopes.html

Apogee also has right angle finders which will accept 1.25" eyepieces.

All of these red dot finders are similar in operation.

Another very popular finder is the Telrad. The Telrad is a sight for pointing telescopes to that "right spot." Through a Telrad you see the sky the way the star charts show it. Not a small upside-down and magnified portion of it, but the "real sky" with three lighted target rings set against it. The large ring is 4 degrees across. It outlines the area covered by a finder scope. The small ring is ½ degree across and outlines the area seen in the telescope. Select an object on the chart and note its position among the visible stars. Then set the Telrad rings on that spot in the sky. A quick rough setting will put the object in the field of a finder scope. With no finder, or a faint object that won't show, use a more careful setting to put the object in the field of the telescope. The Telrad is 8 inches long, weighs a mere 11 ounces and mounts on almost any telescope or spotting scope without drilling holes.



There are also sky maps available with Telrad indexing as well as downloadable Telrad charts such as the ones available at:

http://www.utahskies.org/deepsky/messier/charts/messierTelradFrameSet.html

Another similar finder is the Rigel finder. It projects 1/2 and 2 degree red circles onto the night sky in focus with the stars - what you see in the red circles is what you get in your telescope. Features pulsed or continuous illumination of reticle. Easy clip-on / clip-off mounting to baseplate (no screws to fumble with). Rugged construction, an ultra-efficient LED and lithium battery (included) for long life. QuikFinder attaches without drilling and is easily removed from its baseplate for storage. Additional base plates are available for using QuikFinder on more than one telescope. Baseplate is 2.5 inches long, 2 inches wide and 1/2 inch high. Quik-Finder is 4.5 inches tall, 1.4 inches square.

These finders are available at most fine scope dealers such as OPT and Hands On Optics as well as many others.

http://www.optcorp.com/cart/ProductDetail.asp?PR_ProductID=757

http://www.handsonoptics.com/astronomy/telrad/telrad.html

For those of you who are wanting to do CCD or camera imaging, the small finders just might not be enough. At this point you may want to consider piggybacking a second smaller guide scope on your main OTA if your mount will support it.

I chose the Orion ST80 (80mm f/5) wide field scope to use as my finder and guide scope on my SN10. I still have a red dot reflex finder mounted on the ST80 for quick positioning of the scope. I use a 12mm double crosshair illuminated eye piece which is what is usually mounted in the ST80. It's a very nice little scope with wide field views and works well. Eventually, it will probably be fitted with Meade's LPI AutoStar Suite to be used as an AutoGuider.

The clamshell adjustable mounting rings are available from Scopestuff and the deluxe knobs and reticle eye piece are also from Orion. The diagonal is a StellarVue enhanced 1.25" diagonal.

What's Your Angle...

With any refractor being used for visual viewing, it is essential to have a good diagonal. Unfortunately, many of the commercial scopes available - while offering good optics and construction, just as with finder scopes, they also seem to fall short in their selection of diagonals.

Two excellent values for the amateur stargazer is the StellarVue 1.25" Enhanced Diagonal.

http://www.stellarvue.com/diagonals.html

It comes with a precision optical flat mirror with an enhanced, protected silver coating providing approximately 98% reflectivity. Nylon tipped lock screw to preserve eyepiece barrels. Tested here for proper alignment. Mounted in a standard diagonal body (not a heavy aluminum unit) in order to keep the price low while maintaining a high optical standard. Fit and finish is good. It does not have a threaded barrel. This would be a good immediate upgrade to almost any commercial refractor. The current price of this diagonal is $49.00.

Another exceptional value in refractor diagonals is the 2" model available from Williams Optics. It has a precision 1/10 lambda surface with 10mm-thick mirror, 2"-1.25" adapter with copper clamping ring, reflectivity rate 97.0 percent, Inside diameter (48mm) includes the capability to connect a variety of filters, weight : 470 g.

The build, fit and finish of this diagonal is almost jewel like and it's hard to believe it is only $99.00.

A new Dielectric version of this diagonal that offers all the benefits of the original diagonal, plus a 99% reflectivity dielectric coating on the mirror. This again seems to be an outstanding value at $199.00. Both are available at:

http://www.optcorp.com/cartproductlist.asp?SearchGroup=ALL&SearchBy=PR_MANUFACTID&SearchFor=97

Double Your Pleasure...

Double the time you can use your scope - venture into the realm of solar viewing? I've been using the full aperture Identiview filters manufactured by JMB for quite some time and the views of the sun are spectacular with natural color and great detail. Filters are glass in aluminum cell and fit your scope like a glove. They are identical to the filters sold by another major supplier (the one with the blue stripe). *Always follow precautions when viewing the sun.* They come in several models:

Class A, B, C full aperture solar filters.
Class A & C - Lifetime guarantee / B - 8 year warranty
Class A & B are unlimited visual use.
Class C - photographic use only.

They are available directly from:
JMB., Inc.
736 Oak Glen Circle
Fall Branch, TN 37656
Tel: (423) 348-8883

Flock The Focuser...

Once you have done everything else possiible to eliminate unwanted reflections and stray light from entering the light path, one last item remains - the actual focus tube.

Many people feel this is one of the most crucial areas for eliminating stray light reflections and thus squeezing out that last bit of contrast from the image. Some will even argue that you should "stop down" the actual opening of the focuser with a baffle ring to match the size of the light cone at the end of the focuser for each given eyepiece. This could be tedious in that the size of the opening would have to be adjusted for each focus position of the focus tube as determined by the individual eyepiece. I chose not to do the ring baflle but instead to simply flock the inside of the focuser.

If the inside of the focus tube is already baffled with micro grooves, you should not have to do anything else other than possibly apply a light mist of Ultra Flat Black spray paint to knock down the reflectivity.

If the inside of the focuser is smooth, at the very least you can apply the Ultra Flat Black Paint for a darker tube. IF you want to actually flock the focuser, here is how I did mine.

What you will need:

- ❑ Single edge razor blade and metal straight edge
- ❑ Clear acetate sheet (transparency printing sheets)
- ❑ Your choice of flocking material
- ❑ Ruler
- ❑ Double stick tape (very thin)
- ❑ Krylon Ultra Flat Black spray paint
- ❑ Household waxed paper
- ❑ Clothing lint removal roller

1. Remove your focus tube from the focuser. If you use a diagonal or 2" -> 1.25" reducer, leave it in the focuser. Measure the length of the inside of the focuser fromthe edge of your diagonal or adapter to the end of the tube.

2. Transfer that measurement to the sheet of clear film. Cut the film 1/8" shorter than the measurement. Roll the film into a cylinder and insert it into the focus tube carefully marking where the edges overlap. Remove the film from the tube and cut itt along the line you just made. Insert the cut film back into the focuser and verify that it fits as a fitted cylinder.

3. Remove the film and use it as a pattern to cut out a matching piece of flocking material. Cut it slightly larger as you can trim it down when finished. I used self adhesive backed short pile velvet available from McMaster Carr. Glue or stick the flocking material to the film sheet - trim the edges.

3. Trim the edges, roll into a cylinder and fit it into the focus tube. Check for fit that it will fit flush with the end of the focuser and that it fits tightly around the inside of the focus tube wall. The clear film should have enough "spring" in it to keep it tight against the wall. Trim for a flush and tight fit.

4. If you are satisfied with the fit, pull out the cylinder, unroll it so it is lying flat and roll it with the lint roller to pick up any loose fibers. Change sheets and continue until no more fibers are being picked up by the roller.

5. Lightly - very lightly - mist the fabric with the Ultra Flat Black Paint to remove any sheen and to bond any loose fibers to the sheet. Allow to dry.

6. Roll the sheet into a cylinder and insert it back into the focus tube. Pull it slghtly out of the tube - about an inch - and wrap a strip of the double stick all the way around the exposed end. Do not peel off the backing of the tape.

7. Remove the diagonal or adapter from the other end of the focuser, push the cylinder back into the tube till it sticks out about an inch from the other end and repeat the taping process.

8. Remove the backing from double sided tape. Carefully wrap about a 3" wide strip of wax paper around the end of the cylinder and push it back into the tube till it sticks out of the other end about 2 inches. The wax paper will prevent the double stick tape from sticking to the walls of the focus tube.

9. Remove the backing from the tape at the now protruding end of the cylinder and carefully push it back into the tube until it is flush with the end. Press down around the inside of the focuser to bond the tape to the inside wall of the focus tube.

10. At the other end, carefully pull the wax paper out from between the cylinder and the wall of the focus tube. Reach in with your fingers and press down to adhere the tape.

I hope this guide has been of some assistance. While it In no way pretends to be the best way of doing things, I hope it gives those members of the Amatuer Astronomy Hobby a place to start. A lot of us seem to be of the DIY (Do-It-Yourself) nature and hopefully this guide will inspire new thoughts and even more and better ways to help us all enjoy the hobby.

Clear Skies...
Warp

Acknowledgments:

There are several products, dealers and websites referenced in this document which I found to be very useful in the setup of my scopes and mounts. While this is not an endorsement of any particular dealer and or products, it is simply a representation of products and dealers that have provided excellent support and service in my quest to enjoy the hobby.

WebSites

http://zebu.uoregon.edu/~mbartels/kolli/kolli.html
http://www.heavensandearth.com/Support/EQ3and5.pdf
http://www.efn.org/~mbartels/tm/collimat.html
http://www.astro-tom.com/telescopes/newtonian.htm
http://home.earthlink.net/~flyj/mccluneytext.html
www.lefevre.darkhorizons.org/lxd55/clipectomy.htm
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http://www.starizona.com/basics/polarg3.html

Dealers / Products

http://www.optcorp.com
http://www.scienceandhobby.com
http://store.proastronomer.com
http://home.earthlink.net/~flyj/cecphome.html
http://www.telescope.com
http://www.amateurastronomy.com/tools.html
http://www.scopestuff.com
http://www.jimsmobile.com
http://astrosky.homestead.com/Astrosky.html
http://www.burgessoptical.com

User Groups

http://groups.yahoo.com/group/LXD55telescopes
http://groups.yahoo.com/group/Meade_Autostar
http://groups.yahoo.com/group/meade_refractors
http://groups.yahoo.com/group/LXD55Portal

And many others too numerous to mention.... Thanks to all!