Setting yourself up for low cost macro shooting and getting outstanding quality is easier than you think! There are a number of techniques I’ve been using since first “going digital” that produce macro images some folks find hard to believe were taken with older generation digital cameras, using home-made flash brackets, and junk “add-on” optical components.

For all my macro shooting I presently use several variations of a home-made (thus cheap), but efficient, light modification system made with readily available “bits & pieces” found in hardware and office supply stores. This simple set-up produces true “studio quality” lighting when macro shooting in the field, or anywhere. The lighting effects produced are almost indistinguishable from those of a system utilizing multiple flash heads, or a ring light on a factory made support bracket. The rig provides maximum portability... great for hunting down and following small insects and spiders that might not sit still for photographers using tripods. The intensity of the flash at short working distances allows for the use of very small apertures. This lighting set-up works well with conventional macro lenses, extension tubes, stacked add-on lenses, or any lens and camera combination in a situation where careful control of lighting is required at very close working distances. Because of its light weight, flexibility, and pop-up flash lighting source, you get maximum “bang for your buck” when working at lens-to-subject distances from two feet down to as little as one centimeter, or even less. Working at moderate to high magnifications can result in very short working distances, often so close that getting light onto your subject becomes very difficult. Using this simple rig there’s no problem redirecting the light from the pop-up flash around the end of whatever lens, or combination of lenses is being used, providing enough illumination to shoot at small apertures. Although a variety of factory-made macro lighting rigs are available, their weight and additional batteries required can be a disadvantage at times. Nothing beats “going light” and knowing that camera batteries are the only ones you need to carry.

Jumping spider (Phidippus audax), Newcastle, Texas

Nikon D40, Nikon 105mm f/2.5 AI-S lens focused at infinity, with the objectives from two junk Soligor 90-230mm zoom lenses stacked (both reversed) on the 105. Pop-up flash lighting bounced off foil reflectors, with a lens mounted “direct flash shield” to prevent overexposure. Field width = ½”.
My pop-up flash macro shooting technique / details

**Cameras**: The cameras presently used are a Nikon D40 and a D60, both in manual mode, with autofocus turned off. Focusing is done by moving the camera forward and backward, firing when hitting the sharpness “sweet spot”. The shutter speed is usually set at the fastest speed that allows flash synchronization. Apertures range from f/11 (rarely), to f/32, the average being f/16. The ISO is usually set at 100 to 400, rarely 800. My D40, which has an electro-mechanical shutter, had a flash synchron speed of 1/500 second, until the flash sizzled, popped, and died. Having developed a shutter button problem, and with its dead flash, it only gets occasional use now with a very small low profile Nikon SB-23 speedlight, or is reserved for flashless photography. Because of the E/M shutter, it synchs up to the top speed of the camera... 1/4000 sec.

**Lenses**: My favorites are all older generation manual focus optics... Nikkor-H 85mm f/1.8, Nikon 105mm f/2.5 Al-S, Lester Dine 105mm f/2.8 macro, and a 200mm f/4.0 Al Micro-Nikkor. All are used with the focus kept at infinity. For anamorphic (Cinema-Scope) macro I mount an Iscorama anamorphic compression module onto the primary lens, keeping both the Iscorama and primary focus set at infinity. The “add-on” lens then mounts onto the Iscorama, which has been fitted with a 72mm to 52mm step-down ring.

**Lighting**: Pop-up flash bounced off foil covered reflector cards, or shot through a “bowl diffuser”. When using the bracket’s reflectors a clip-on “direct flash” shield is mounted on the lens and positioned to block direct pop-up flash light from striking the subject, possibly causing severe overexposure. Occasionally the bowl diffuser and reflectors are used together, with the reflectors positioned to bounce additional light onto the back of the diffuser, for those situations where more illumination is needed at very small apertures.

**Metering**: None. My older lenses have no way of communicating with the camera, so all exposures are evaluated by viewing the camera play-back screen and checking the histogram. I usually set the viewing mode to blink any overexposed highlights.

**Support**: None. No tripod or monopod. All the macro shooting I do is hand held. Focusing at very high magnifications can be difficult, especially with subjects such as live creatures going about their business, or inanimate objects being moved around by wind. Working free-hand allows me to constantly shift the camera, following the subject’s change in position. I do use a favorite mop handle to steady my hands, or lean on in cases where I might become overbalanced and fall forward.

**Magnification**: This is achieved mainly through the use of various “add-on” (supplementary) lenses mounted on the front of the primary (camera mounted) lens, leaving that lens focused at infinity. Using front-mounted supplementary lenses doesn’t result in any loss of light. Teleconverters, extension tubes, bellows units, and other components mounted between the camera body and your primary lens are “light robbers”. These I use only when working with unusual lenses, such as those from movie cameras, or certain microscope objectives.

**Add-on lenses**: Many of my add-on lenses are objectives from junk, broken lenses bought cheap on ebay, at yard sales, in second hand shops, or “donated” by fellow photographers. These are fitted with double-male threaded macro reversing rings to allow mounting on the 52mm filter ring on all my primary lenses. Projection, enlarging, and movie camera lenses are also used. Any add-on lens having an aperture is used at its widest setting.

“**Field width**” vs. “**X-factor**”: 1x, 2x... 5x, or what? How much “x” do you need???
An easy way to deal with this question is to forget the “x” factor and think in terms of what each add-on lens gives you for field width when used with various primary lenses. When preparing to go shooting I consider what field width range I want to work with, and carry several supplementary lenses that will cover it. Some can be stacked, serving “double duty”. I often carry a small card with field width and working distance data listed for the various add-on lenses used with the particular primary lens that’s on the camera. After finding a subject it usually gets photographed at low magnification, then for detail shots I shift to an add-on lens having a narrower field of view.
Supplementary lenses... turn any lens into a macro lens

**Optical quality / lens “matching”:** There’s an almost endless variety of lenses that can be used as add-ons. Not all are good optical matches for some primary lenses. Many give outstanding results, others... not so great. Some are really dreadful... absolute “dogs” no matter how they’re used. Never give up on a prospective add-on lens until you’ve tried it on all the lenses that you do close-up shooting with. One that performed miserably on all my primary lenses almost got junked before I tried it on my 200mm Micro-Nikkor... discovering that it was a perfect optical match for use only on that lens, producing wonderfully sharp and contrasty images.

Some of my more useful supplementary lenses

**Nikon 3T and 4T close-up lenses:** These are two element highly corrected close-up lenses offering great image quality. Now discontinued, many manufacturers make similar products. These are used singly, stacked together, or combined with other add-on lenses.

Nikon D60, Nikkor-H 85mm lens, Iscorama anamorphic compression module, Nikon 4T close up lens mounted on the Isco. Pop-up flash lighting shot through a diffuser made from the bowl that comes in a Marie Callender “Steamer” frozen dinner.

**Raynox Macro Conversion Lenses:** Raynox makes a line of very high quality add-on lenses in various strengths. Using their UAC2000 universal adapter, they snap onto any lens having a filter ring sized from 52mm to 67mm. The DCR 150 and 250 are the easiest to work with, having the greatest working distance. The MSN 202 is a bit challenging to use, with a much shorter working distance. I regularly use a DCR250 and MSN202, and their clarity, contrast, and sharpness is outstanding.
**Slide Projector Lenses:** Many fixed focal length slide projection lenses make high quality macro lenses when used reversed. My favorite is an old Kodak Ektanar C 102mm f: 2.8 from a broken Kodak Carousel slide projector. With a little work a 52mm reverse adapter can be fitted to the front end. The excess barrel length at the other end is trimmed back with a small hacksaw to within about ¼ inch of the lens surface. This allows more room for light to be directed around the end of the mounted lens onto the subject.

![Nikon 105mm f/2.5 AI-S, Ektanar C 102mm (reversed)](image)

**Movie Projector Lenses:** Fixed focal length versions are great for high magnification shooting. Use these reversed to get any kind of useful working distance. Depth of field will be extremely shallow. Here's a Bell & Howell 1 inch focal length “Increlite” f/1.6 projection lens found on many old Bell & Howell regular 8mm movie projectors. Mine came from a broken projector someone was discarding. Here it’s mounted in an adapter made from a balsa-wood disc held in empty filter rings. Hardware store rubber grommets pressed together against both sides of the disc keep the lens parallel with the camera back. The small end goes toward the subject. The large end toward the camera... with two more empty rings to prevent contact between theIncrelite’s barrel and the primary’s glass.

![Increlite 1” f/1.6 Nursery Web Spider tarsus on web, Nikon PN-11 tube, 105mm f/2.5, Increlite 1” on the 105.](image)
**Movie Camera Lenses:** Lenses with focal lengths from roughly 1” to 1.5” are very useful when used reversed and yield excellent results. These can be very difficult to use due to their extremely short working distances. Depth of field will be very shallow and focusing while hand-holding will be quite a challenge. One of my favorites is an old Soligor “Elitar” 38mm f:1.9 telephoto “D” mount lens from a Sankyo 8mm movie camera.

The bellows is an old Macrobel unit with a Nikon F mount. The Soligor Elitar 38mm f/1.9 "D" mount cine lens is reverse mounted on a home-made ring inside the Accura extension tube on the front. The focus has been “locked” at infinity with a rubber band wound around the lens barrel, hidden inside the Accura tube. Because the aperture ring is inaccessible after the lens is mounted, the shooting aperture... f/8, must be pre-set, which means the image in the viewfinder is pretty dim. The flashlight (for composing / focusing) is screwed onto a tripod mount from an older 200mm Micro-Nikkor that someone sold and forgot to include with the lens. A “Mini” macro bracket with reflectors gets mounted to a tripod socket under the front bellows standard. Working distance with the bellows extension shown (6”) is .75”, with a field width of just under 4mm. When the lens alone is mounted on the 105mm or 200mm micro-nikkor, the aperture is left wide open.

**Enlarging lenses:** My wet darkroom days are over, but my enlarger’s lenses live on, serving as very high quality macro add-on lenses... used reversed with the aperture wide open. Almost any enlarging lens works well, but some older ones may have lower contrast than lenses with more modern coatings.

On the underside of a Goldenrod leaf... an early effort at macro shooting with a first generation pop-up flash macro rig. Nikon D40, AF-S Nikkor 18-55mm f/3.5-5.6 G VR zoom lens, zoom set @ 55mm, 50mm Apo-Rodagon enlarging lens (reversed). Auto-focus off. “Push-pull” focusing, Lighting provided by the camera's pop-up flash.
**Lenses in shutters from old folding cameras:** These can be great macro add-ons when used reversed with the aperture wide open. If the lens has front-element focusing, I set it at infinity. Look for old anastigmats, Tessars, Velostigmats, etc. This ancient 7 inch Triple Convertible Velostigmat performs well on a bellows in its normal configuration with three stacked Zeiss “Proxars”, and by itself as a reversed add-on.

![Wollensak 7” triple convertible Velostigmat](image1) ![Funnel Weaver in its “tunnel” entrance](image2)

The spider was shot hand-held through the glass wall of a terrarium. Nikon D40, Wollensak Triple-convertible Velostigmat in an Optimo 1A shutter, F/11, ISO 400, 1/4000 second, Nikon SB20 Speedlight bounced off foil covered reflector cards. This was taken soon after destroying the D40’s pop-up flash, so using the small speedlight was the only option available. The lens was mounted on a Spiratone "Macrobel" bellows, with 5.5 inches of extension. Three Zeiss Proxars from the late 1920's and early 30's were stacked on the front of the Velostigmat... a 1.3x Zeiss Ikon, 1.5x Zeiss Jena, and a 2x Zeiss Jena. The triple convertible Velostigmat was used in its "normal" configuration (front & back elements mounted). The shutter was set on "T", and the exposure made with the D40.

**Microscope objectives:** These generally have extremely short working distances and paper-thin depth of field. Most will produce vignetting that can be cropped away. The easiest to use are those having relatively low magnification and wide apertures.

**Front lenses (objectives) from junk zooms:** (My favorites) Almost always of very high quality, they work just like a close-up lens. These should be used reversed to give the flattest field and sharpest resolution. Good examples are front cells from macro-focusing zooms. Excellent choices are objectives from Soligor or Lentar 90-230mm zooms, and 300, 400, and 450mm telephotos.

![Soligor objectives, back side view](image3)
Case history: Olympus IS-3DLX objective recovery & use

This scary-looking lens "operation" yielded a powerful and wonderfully sharp add-on lens for reverse mounting on a Nikon AI-S 105mm. This Olympus IS-3 DLX film camera (totally dead), spent about 20 minutes in the surf at a local beach. The intent here was remove the front lens group cell containing 2 elements, and be able to reverse mount the unit onto the front of another lens using a double male macro reverse adapter. The objective group was removed from the camera body after an hour of tedious disassembly. The lens is mounted securely to a cheap miter box to allow cutting without the lens moving about. The hose clamp serves as an alignment guide to give a cut that's parallel with the front of the lens barrel. Careful measurements were taken to ensure that the saw blade cleared the back of the lens and left enough barrel length to serve as a lens shade when reversed. The cut edge was given a "machined" finish by filing to remove burrs and careful sanding with various grits of emery paper to give a flat edge with a very slight bevel. All done, the element looks like an off the shelf store-bought item. Only the information around the lens gives away its pedigree.

On the left is a small frog sitting on a stone on my back porch, taken with a Nikon 105mm f/2.5 AI-S lens at its closest focusing distance of just over 3 feet, without any add-on lens. The closer image was taken with the front lens group (objective) of the Olympus 35-180mm lens removed from the Olympus IS-3 DLX film camera, reverse mounted onto the front of the 105mm using a 52-52mm macro-reversing ring. Focus was set at infinity. The reflections are the foil covered reflector cards on my home-made pop-up flash macro bracket. After one extremely close pop of the flash the frog was gone. Focusing when using these close-up add-ons is done manually by moving the camera forward and backward until the image is sharpest. The primary lens is always set at infinity to provide the most working distance. Despite using an aperture of f/22, depth of field is very thin.
Special Adapters

**Macro Reverse Adapters:** These are used for reverse mounting another lens face-to-face on your camera's lens, and are probably the most useful item to have in your macro “kit”. Common sizes: 52-52mm, 52-55mm, 52-58mm, with an almost endless variety of combinations available. Available from most photo equipment vendors. Always buy metal with ribbed or knurled edges, not plastic! These will last forever, be easy to remove, and cost about the same as any plastic ones you'll come across. Also, plastic rings on metal can jam... and will always do so at a bad time.

**Step Up / Down Rings:** used for fitting add-on lenses with particular sized mounting threads to lenses having larger or smaller sized threads. As with the reverse adapters... go with metal versions.

**Raynox “Universal” adapters:** Several close up lenses offered by Raynox come with their “UAC2000 Universal Adapter” snap-on adapter that is designed to fit lens filter rings of 52mm through 67mm, a neat, almost “one size fits all” solution. The adaptor can be bought separately for under $10 and has dozens of uses for the “do it your self” photo equipment “hacker”.

**RMS to 52mm Thread Adapter:** for fitting a microscope objective having the standard “Royal Microscopical Society” thread to lenses having 52mm filter threads. Mine is a machined aluminum disc with the outer edge threaded to fit 52mm, with an RMS threaded hole in the center. My first was a simple disc made from a piece of mat board, having a hole cut in the center into which the threaded portion of an objective was screwed or press fitted. Available on-line to match a variety of lens filter thread sizes.

**Home-made “anything goes” adapters:** Some lenses you encounter seem to be unusable as a supplementary lens without expensive machine work being done first. This is when you have to use a bit of creativity. A visit to a hardware or craft store might be necessary. I've made lens adapters from paper mailing tubes, PVC pipe, sump pump fittings, toilet tissue tubes, parts of plastic pill bottles, 35mm film cans, “Pringles” potato chip cans, etc. All sorts of stuff can be adapted to mount an unusual lens onto a filter ring that will then allow it to be screwed onto your regular lens. The method you use to mount an auxiliary lens onto your primary lens doesn’t have to look pretty! Functionality and final results are what counts. Mini-bungee cords are almost indispensable at times.

**Bellows rail / focusing units:** All the techniques and equipment mentioned in this document can work well with bellows units mounted directly on a camera body, but non-automatic versions present special problems when shooting “free-hand”. I've rigged a standard lightweight (non-auto) bellows for for hand-held use with pop-up flash, but it's difficult to use. You have to pre-set the shooting aperture, which produces, at higher magnifications, a very, very dim viewfinder image, requiring the use of a small high intensity LED flashlight pre-aimed to illuminate the area of sharp focus in front of your lens. This is only practical after first testing to establish the aiming point for this manual “focus assist” light. Auto bellows that offer full open aperture focusing, stopping down only when firing the shutter, eliminate this problem, but are expensive. Using any bellows unit along with the macro bracket results in a significantly more bulky rig that can be very difficult to “aim” at higher magnifications. Locating your target in the viewfinder can be almost impossible at times, and depth of field when using any significant bellows extension will be exceedingly thin.
Macro bracket light modifier: Uses only a camera's pop-up flash!

The macro-bracket set-up consists of three assemblies: a camera mounted reflector and support group, a “direct flash” lighting shield, and a “bowl diffuser”. The shield and diffuser mounts just like a lens cap onto your outermost lens, whether it be an add-on, or your primary lens. The light from your pop-up flash fans out from the strobe, strikes the reflector cards, and is redirected around your lens onto the subject. The lens-mounted shield prevents direct flash light from striking the subject. Working at very close distances, the intensity of the pop-up flash could result in severe overexposure. In some situations where a high magnification add-on lens is used, the working distance can be short enough to where the lens itself prevents direct flash lighting from falling on the subject. The bowl diffuser is used when soft lighting is desired. It can be used with, or without the flash shield. Clipping a small piece of black paper or a painted piece of another bowl onto the diffuser allows for varying the direction and intensity of the diffused lighting.

The basic bracket

![Image of basic bracket]

Shown with a wing nut “keeper” on the camera mount knob, mounted standard reflectors, extra “mini” reflectors, binder clips, and spare clothespins. The small binder clips are for mounting reflectors when they're positioned closer to the camera body, causing the longer clothespins to crowd your shutter button hand. Covering thin cardboard with aluminum foil, dull side out, makes reflectors that provide one stop more illumination than bare white cards. Having the shiny side out makes the cards perform more like mirrors, resulting in hard edged shadows and annoying reflected “hot-spots”. The large size of the cards relative to the sometimes tiny subjects I photograph gives lighting that has true “studio quality”, similar to lighting you get when working in a studio with large soft boxes, umbrellas, or diffusers. In some cases you can't even tell flash has been used. Lighting ratios can be regulated simply by swinging one or both cards in or out, or bending them up or down slightly. By adjusting the card and support arm angles you can provide lighting in situations where your lens is as close as several millimeters from your subject. This lighting setup works great at lens-to-subject distances ranging from about 18 inches down to less than ¼ inch, providing a quality of lighting at high magnification that's hard to beat at any price.
**Simple to use:** Mount the bracket on your camera’s tripod socket, attach the “direct flash shield” to your lens. Set the angle of the bracket “arms”, position the reflector cards, and start shooting. After a few test shots, screen image evaluations, and any necessary minor adjustments to aperture, shutter speed, ISO, or reflector card positioning, you can “fire away” as long as you like. Adjusting the angle of one, or both cards offers a high degree of contrast, shadow, and detail control. Using larger reflectors will provide light with softer shadows. Smaller reflectors will give harder edged shadows. When positioning the reflectors be careful that they don’t contact anything in front of the lens. It’s easy to have a small insect or spider spook and disappear because a reflector card touched its perch or web. You can produce various colored effects or change the amount of light reflected by covering the cards with different materials. Many times swinging one reflector away entirely works well... giving strong directional lighting and increased contrast.

There’s no need to break down the bracket after a shooting session. Simply leave it assembled with a wing nut as a “keeper” to hold the mounting knob and washers together after removing your camera. It can fold up for packing, becoming a fairly small package. For most efficient storage in a back-pack leave the knob and washers together, removing the support rods, clothespins, and reflectors.

**Typical set-up... “Mini” version:**

![Image of camera setup with reflectors]

This short arm bracket is for working at very close distances with high magnification lenses and objectives. Here it’s shown with a Nikon 20x comparator lens on the D60. The direct flash shield, which mounts on a ring about 2” behind front of the lens, was left off for the photo. Working distance with some lenses can be so short that the end of the lens actually serves as its own flash shield. Binder clips are used to hold the reflectors because longer clothes pins used with shorter bracket arms crowd my shutter button hand. For this application, small 1/4 x 20 female knobs are used to mount the reflector support rods to the two arms. I was photographing a subject on a table top, and focusing by sliding the camera bracket forward and backward on the smooth table surface. Nylon wing nuts would have worked as well. The reflectors are set wider than normal for this photograph. Here, this unusual lens is mounted on the body with a Nikon F to T-mount adapter that I modified to accept its totally non-standard threaded mounting ring.
I keep a quick-release plate on the bottom of my cameras, using the plate's extra tripod hole to attach the bracket. Constant tightening and loosening of the knob could accelerate wear on the camera's tripod mount threads. The neoprene washer gives a slightly “spongy” grip, preventing the knob from loosening. When removing the bracket from the camera, make sure the rubber washer doesn't remain stuck to the quick release plate. The nylon washer allows for smoother angle adjustment of the bracket. There's no need to tighten the knob to the point where the “arms” are locked into a condition of absolute immobility. I find it useful sometimes to have an amount of tension that allows some adjustment by simply pushing them in or pulling them out. All my shooting is done hand-held, bracing and steadying my arms on anything that's handy. In a situation where camera motion seems to be a real problem, I might support the camera using a stick I pick up along my walk. On those occasions where I've lugged a tripod along, the camera doesn't get mounted on it. The tripod legs are used to provide something to brace my hands or arms against while shooting... very convenient when following a small moving subject. Sometimes I'll stash the tripod out of sight somewhere, to be retrieved later, and just go with a short stick. The bracket could easily be modified to allow tripod mounting for those folks who find shooting unsupported at very short working distances a bit difficult. Using a Nikon PN-11 tube, or something similar, can be convenient because it comes with it's own mount, allowing the entire assembly to be tripod mounted if you feel it's necessary.
Make your own pop-up flash macro bracket

Excellent brackets can be made using two pieces of thin wood or aluminum having ¼” holes drilled to allow camera and reflector support rod mounting. Here’s a completed bracket, and the parts needed to build this “basic” unit.

![Assembled bracket](image)

**Bracket parts list:**

**Flat aluminum bar stock**, (one), 1/8” x 3/4”, available in 4 ft lengths at most hardware stores for around $8. This will provide enough material for several brackets. I’ve found that a bracket arm length of 9” is very convenient, plenty long enough for most macro shooting inside of 18”. Don’t buy the “anodized” material... it costs more.

**Threaded rod**, (two), 1/4 x 20 threads, 6 inches long. These are used for supporting reflectors on the bracket arms.

**Knob**, (one), 1.5 in. diameter with ½ inch shaft, 1/4 x 20 threads.

**Fender washer**, (one), steel, 1.5 in. diameter, with ¼ in. hole. These are optional, used as shims for knobs having a longer threaded shaft.

**Nylon washer**, (one), 1.25 or 1.5 in. diameter, with 1/4” hole.

**Fender washer**, (one), neoprene, 1.25 or 1.5 in. diameter, with ¼ in. hole, less than $1. These provide soft compression when mounting the bracket on the camera, preventing the bracket arms from loosening suddenly once the knob is tightened.

**Hex nuts**, (four), 1/4 x 20 threads, for making two “jam nuts”.

**Nylon wing nuts**, (three), 1/4 x 20 threads, for mounting reflector support rods. Nylon mounting nuts have some “give” when mounting the rods, and are unlikely to loosen unexpectedly, as when using a metal wing nut.
Cardboard, (two), 4 x 5 in. or whatever size you want to work with, covered with aluminum foil, dull side out. Thinner material can be flexed and shaped a bit to provide more focused light when needed. I have several sets of foil covered reflectors: 6” x 8” for soft lighting at longer working distances, 4” x 5” for most subjects down to a working distance of about one inch. I also have 2” x 3” reflectors, and even smaller ones, for really tight spaces, or when the working distance shrinks to 1/2” or less.

Plastic or wood clothespins, (four), to hold reflector cards on threaded support rods. Plastic pins generally have better gripping power than wood. The pin is used to press the reflector against the threaded rods, providing good, fairly rigid, yet adjustable support.

Small binder clips, (two), use in certain situations instead of clothes pins to mount reflector cards on support rods. These are VERY strong, and will hold the reflectors quite firmly, making adjusting card angles a bit more difficult, so use one only per card.

**Construction details... Bracket arm work**

**Cutting**... Using a hacksaw, cut your bar stock to a convenient length, then deburr the cut edges with a fine file, emery paper, or fine wire wheel. Arms about nine inches long work well in most situations.

**Drilling**... Mark the position of the camera mounting knob hole, as well as the holes for reflector rod mounting. You can put several holes along the length of each arm, allowing you to change the rod positions when working distances vary. I start off with a small bit, working up in size, and finishing with a 1/4 inch bit. Using a variable speed drill, I go slowly to avoid excess heating, and to keep the “broadcasting” of metal shavings under control.

**Deburring**... Using a tapered conical stone on the drill, or a small hand-held rat-tail file, carefully deburr or burnish the rims of the holes. This makes it easier to insert the reflector support rods, and looks better too.

**Finishing**... I usually put a fine wire wheel on the drill to remove the dull factory finish of the bar stock, brightening the look of the bracket, and making it appear a bit like a pricy, store-bought item.

**Reflector support rod work**

**Grooving**... Using a vise to hold them, with a hacksaw cut two shallow grooves at right angles to one another on one face of two nuts. These will form the bottom of the jam nut and seat firmly against the bracket arm when mounting the rods.

**Measuring**... Screw an ungrooved hex nut onto a rod and insert it into a bracket arm hole, setting its distance in from the end so that enough rod can extend through the arm to allow screwing on and tightening a wing nut... around 3/8 inch. Remove the rod, then apply a reference mark at the point where the bottom face of the nut sits on the rod. This is the distance along the rod at which the grooved surface of the “jam nut” will make contact with the top surface of the bracket arm. Add a grooved nut, slotted face toward the end of the rod, and gently snug it up against the first nut. Screw in the pair until the grooved face of the bottom nut just clears the reference mark. Then, using two small wrenches, screw both nuts toward one another, applying enough torque to firmly “jam” them, being careful they don't travel down the rod a bit in the process... below your reference mark. Once jammed tight, they should never loosen. Now securely mounting a reflector support is simply a matter of inserting the rod to the limit set by the jam nut, and screwing it tight with a nylon wing nut. To remove, loosen the wing nut a bit and rotate the rod.
Reflector support rod detail

After determining the final position for the reflector rod jam nuts, use two wrenches to turn them toward each other, locking (jamming) the nuts permanently in position on the rod.

Jammed nuts, permanently locked in position, with enough shaft exposed to allow mounting on bracket with wing nut.

Cut slots on face of nut contacting arm of bracket (Provides a good, non-loosening connection). Wing nut will draw the cut face tight against the arm without the need of a star or lock washer.

Slot cut in nut bears against surface of arm making a solid non-slip connection.
Here are two items used with the macro bracket. One is necessary... the direct flash shield, the other is a nice option... the frozen dinner bowl flash diffuser. Both are adapted for mounting on the front of a lens using a Raynox UAC2000 snap-on lens adapter. It allows mounting Raynox macro lenses (and now my attachments) on any lens having a filter ring between 52mm and 67mm. It fits on like a lens cap by pressing two tabs. This convenient adapter is the 43mm model supplied with their DCR-150 and DCR-250 macro lenses, and is available separately (lensless). If focusing your lens results in the shield or diffuser rotating away from its position directly in front of the pop-up flash, simply squeeze the two mounting tabs and reposition the shield.

The diffuser is made from the plastic bowl that comes with a Marie Callender or Healthy Choice “steamer” frozen dinner. It provides diffused pop-up flash lighting, with soft edged shadows. Clipping a small piece of black paper or plastic on the back of the diffuser allows you to selectively block a portion of the flash, creating directional soft lighting, adjusted by moving the material right or left. Bowls from any dinners having tomato sauce shouldn’t be used. Even after vigorous scrubbing, running through a dish washer, or soaking in a variety of cleaners and solvents, a faint orange stain will remain. This will produce a color shift in your images. Most other varieties are OK, their bowls being completely neutral, as with the one in this photo.

**Direct flash shield and “bowl” diffuser**

**Direct flash shield / “bowl” diffuser parts list**

Raynox UAC2000 adapter... Most photo equipment vendors, $7.95 to $9.95.

Flash shield material... Staples “M by Staples” Arc System Tab Dividers, black polypropylene, 5-5/6” x 8-1/2”, a package of five... $3.99 at Staples.

Frozen dinners, “steamer” type... most large supermarkets, around $2.89.

Small machine screws, washers, and nuts... 9 of each, for assembling the flash shield and bowl diffuser.
Direct flash shield details

Made from a piece of Staples polypropylene tab divider material attached to a Raynox UAC2000 snap-on macro lens mount. For use with most pop-up flashes, cut a rectangle of black tab material measuring 3.25” x 5”. If you intend to use a shoe mounted external flash, extend the length of the shield material to allow for the greater height of the flash unit. Trim one end of the piece as shown... to fit around the hole where a Raynox macro lens normally goes. Cut carefully to avoid any material from extending into the lens opening. Keeping this hole completely clear will enable you to fit a Raynox lens in the snap-on mount as it does normally, if you get one in the future. From the back, drill small holes through the adapter for the screws used to attach the shield material. Holes should be centered in the small cavities on the back of the adapter, allowing room for small nuts to be applied to the screws. Backing the screw heads with washers will provide better support for this flexible material.
Frozen dinner “bowl” diffuser details

This handy diffuser makes use of the same Raynox UAC2000 snap-on lens adapter used for the shield. The best method I've found for cutting and shaping the plastic is to use small curved scissors used for embroidery, and do final trimming with an Exacto-knife fitted with a sharp (new if possible) blade. To ensure accurate positioning of drilled screw holes, I center the flat surface of the adapter against the outside bottom of the bowl, taping it in place. When drilling through the adapter, GO SLOW!! I hurried on one occasion and split the adapter. Trimming away the material on the lower half of the bowl will permit close low-angle focusing (as on a table top), otherwise it can be an obstruction. Taping or clipping a small piece of black paper or a small piece of thin black rubber “waffle” shelf liner material somewhere along the curved outside surface of the bowl will allow you to provide directional soft lighting.

Are you interested???

Try building one of these rigs... you'll really like what it can do for your macro shooting. If you enjoy “do it yourself” projects, then add construction of this item to your “to do” list. Build the unit as described, or use these instructions as a guide in constructing your “better” version. After a little practice, the results you'll get using just your pop-up flash will amaze you. This rig works fine on film cameras, but is a pure pleasure to use shooting digital. Once set up, you can stalk or chase down small creatures, shooting away almost as fast as you want. If your subject is in focus... your flash exposure will be right on... and the lighting effect you choose absolutely repeatable.

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