Electronic Focusing On The Cheap
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I've made some significant changes to my telescope (a Celestron C8 OTA) in the last little while, moving to a new Celestron Advanced Series/GT Goto mount mount on a pier in my roll-off roof observatory. Overall I'm interested in creating a fully robotic telescope so when the mosquitoes are bad I can head inside and still be able to image and engage in some of the activities I'm interested in with the scope. With Goto taken care of by the AS/GT, two other requirements remain: auto-focusing, and guiding.

There's really two reasons to implement electronic focusing - for visual and imaging applications, a powered focuser eliminates problems with vibration during focusing, which becomes much easier if the object in the eyepiece isn't bouncing around every time you touch the focus knob. Obviously, as well, there's no way to focus remotely for imaging and remote operation without one.

After having a look at a number of solutions that were somewhat out of my price range, I decided to take a chance and bought an Orion AccuFocus from Orion, an inexpensive focus motor intended to mate up with Orion Rack and Pinion focusers. Based on what I could see of the mounting hardware, I was confident somehow I could make it work on my C8. The AccuFocus arrived within a week at a total landed cost of about $65CDN. The normal installation of the motor is as below, replacing one of the focus knobs on a rack and pinion focuser.

Obviously, Schmidt-Cassegrains don’t have rack and pinion focusers unless you add a microfocuser on the back of the scope, which is fairly big bucks. I started measuring it up in hopes I could fabricate an aluminum bracket of some kind to position the motor so it could be mated up with the shaft for the focuser knob. However, I realized that simply attaching the supplied bracket to the scope and using a belt, I could drive the focus knob without having to directly mate up the drive with the focus axle, and incidentally could avoid having a great big motor sticking out of the back of the scope to maneuver around while trying to get to the eyepiece. I drilled one hole in the bracket supplied with the focuser, grabbed a belt from my junk box, and I was in business! The C8 has several

attachment points with screws intended for mounting dovetail weight and guide scope systems, so I used one of these screws to secure the focuser mount. Initially, for a belt I tried an elastic band but the motor would start turning a while before the knob moved because the elastic stretched (duh!), then the knob would spin til the tension was released. Not good. However, the more inflexible belt seemed to work well, rotating the knob easily using friction yet with a bit of slip to it so I can actually turn the knob manually without disengaging the belt. The result is below.

However, a test under the stars made it clear that while the setup worked to a degree, the belt slipped too much for precision, and belt might slip off the end of the flexible coupler included with the AccuFocus. So, Version 2 of the modification added some gears to both the focuser axle on the C8 and the AccuFocus. I note that once in an AstroTinkerer's career you need to disassemble a large machine (in my case a photocopier) which provides a lifetime supply of gears, belts, and miscellaneous "junk box" parts! The completed focus unit with hand pad can be seen in the pictures of my scope, ready for observing. This works very well and seems to be reliable enough to use unattended without running into problems. However, there's no way to use the hand pad to focus remotely so some other components are required.

With the focuser modification complete it was now time to make the focusing function controllable from the observatory computer. This was achieved using a FCUSB (USB= Universal Serial Bus) focus controller from Shoestring Astronomy. I also ordered a GPUSB auto guider interface which I haven't yet got hooked up and running.

The FCUSB focus controller replaces the hand pad for the focus motor with a box that attaches the the computer via a USB port and allows computer controlled focusing out of various software packages including K3CCDTOOLS. Since I have a fair bit of USB devices attached to the scope (including a web cam, Meade Deep Sky Imager, the FCUSB, and eventually the GPUSB guider interface) I mounted a USB 2.0 hub on the deck of my oversize pier to mount adapter so I only have one cable going to the observatory computer instead of many. This should make cable management a lot easier!

Initially I've been using the FocusPal software that comes from Shoestring for the FCUSB for focusing, but I'm hoping to try FocusMax shortly, a Freeware application that autofocuses your telescope by analyzing the apparent diameter of the star you're using as a focal point and changing focus until it's diameter is minimized. While it doesn't directly support the FCUSB, since Shoestring provides ASCOM drivers (a standard for inter-operable astronomy devices and software) for the FCUSB, so it works just fine. K3CCDTOOLS also has focusing capabilities although it's not entirely clear how it works – this is a great piece of software, but a bit under documented.

More on the FCUSB and hopefully some results of testing the GPUSB guide interface next month hopefully. Clear Skies!

Links

Orion Telescopes (AccuFocus)	www.telescope.com
Shoestring Astronomy (FCUSB)	http://www.shoestringastronomy.com/
K3CCDTools (imaging software)	http://www.pk3.org/Astro/
FocusMax	http://users.bsdwebsolutions.com/~larryweber/
ASCOM	http://ascom-standards.org