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**Bob Denny** ◦  
Developer

Join Date:	Oct 2005
Location:	Mesa, AZ
Posts:	29,846

**Downloading and Using PinPoint Reference Catalogs (Updated April 2021)**

**Which reference catalog should I use?**

We recommend against USNO UCAC4 for plate solving [for telescope pointing](#) because it lacks stars fainter than mag-16 and has only about one hundred million stars, where the smaller USNO A2.0 has *five times as many stars* and includes many more faint (down to mag-18) stars. This can make plate solving with A2.0 more reliable. The small errors in a few individual stars (proper motions) in A2.0 are irrelevant for telescope pointing. While reading this article, keep in mind that a **1Tb (1000Gb) portable USB drive** is \$50-ish and a **1Tb (1000 Gb) portable Solid State USB drive** is \$130-ish. **What's the big deal about the full ATLAS taking 0.16 Tb?**

The short story: For telescope pointing usage in ACP, MaxIm, FocusMax, etc. which use PinPoint to get hyper-accurate image center point coordinates, use either the GSC-1.1 or the USNO-A2.0. The choice depends on your field of view. If it's more than 20 arc minutes, you can use the GSC. If less, you should consider the A2.0. The latest 7.0 version of PinPoint virtually eliminates the problem of too many catalog stars from A2.0 for very wide fields. The limit is now 200,000 so even wide-field systems can use the A2.0. Bottom line: use A2.0 if you can, and if you have the disk space (see above) use the ATLAS catalog to go deep (19 or 20 mag) and reduce your pointing exposures to the minimum.

For precision astrometry of individual objects in an image, the choice of catalog is more dependent on what you're doing, but in general the USNO UCAC4 catalog is a great choice. It is the one that is recommended by the IAU Minor Planet Center and others for precision astrometry. Even better is the new (2018) **ATLAS All-Sky Stellar Reference Catalog ("ATLAS-REFCAT2")**. It is large (from 18 Gb to 160 Gb depending on the magnitude range you want). The full 160 Gb catalog has approximately one billion stars down to magnitude 20 or so. Astrometric positions come from Gaia DR2, and photometry from several sources. See [the Tonry et al. paper](#) for more info on the magnitudes. .

**How do I get the Catalogs?**

**Note:** Do not attempt to use Internet Explorer for FTP access. It is just too lame. Use an FTP application like the free [FileZilla FTP Client](#). Be sure to set your FTP program to "binary" transfer mode. Auto can result in corrupt catalog files from some of the catalogs. Binary always works for binary data catalogs.

**Guide Star Catalog:**

As of October 2003, the STScI GSC in its original format (FITS tables) is no longer available from NASA ADC. In order to support our customers, we have placed this catalog online at <http://gsc.dc3.com/>. Detailed instructions are in the readme.txt file at the above address. If you have a reliable net connection, download the self-contained installer (300+ MB) then run it. You can trash the installer after that.

The most common problem with the GSC is having the wrong directory layout. The 2-CD set from ASP, as well as the online distribution at <http://GSC.DC3.com/> has the catalog files in a subdirectory called **GSC** and the table files in a subdirectory called **TABLES**. PinPoint is designed to work with the CD-ROM root/drive as the path for all of its catalogs, and GSC is no exception. Set PinPoint's path to the *parent* directory of the GSC and TABLES directories, wherever it is.

If you are using the 2-CD (uncompressed) version of the GSC/1.1 as obtained from (e.g.) the Astronomical Society of the Pacific, you must have two CD-ROM drives (or copy the contents of both CD-ROM into a common directory on hard disk). When using 2 CD-ROM drives, enter the drive letters for the north disk and south disk separated by a semicolon (e.g., "N:S:") This will also work if you choose to copy the North and South CDs into separate directories on (possibly 2 different) hard disk(s); separate the north and south directory paths with a semicolon.

#### USNO A2.0

This is a large catalog (6Gb), and while old, *this is still the "one to use" for common plate-solved telescope pointing applications* because it goes deeper than the others, and includes bright stars. The fact that some nearby stars' proper motions are out of date has an insignificant effect on the centering accuracy of the solution. If you have a solid internet connection, you can get it as [this single 4 Gb zip file hosted on DropBox](#). You can also download it in bits and pieces at night if needed. Get it via <http://usno2.dc3.com/>. Read the [A-HOW-TO-DOWNLOAD.txt](#) document at the top by clicking on it with your browser. Now back up and using those directions, copy the zonexxxx.acc and zonexxxx.cat.zip files to a directory on your system. Unzip the cat files and throw away the .cat.zip files. Set your catalog type to USNO A2.0. Set your catalog path to the directory into which you copied the files from USNO. Sorry but the USNO service has been closed.

#### USNO UCAC4 (PinPoint 6 or later only) [*This is a compilation of Comm Center notes from Bob Denny, Eric Dose and Dick Berg.*]

The UCAC4 is a large catalog (over 8Gb), but it is "the one to use" if you are doing precision astrometry with PinPoint 6 or later. Get the catalog from CDS at <ftp://cdsarc.u-strasbg.fr/pub/cats/I/322A/UCAC4>. [CDS stands for Centre de Données astronomiques de Strasbourg.]

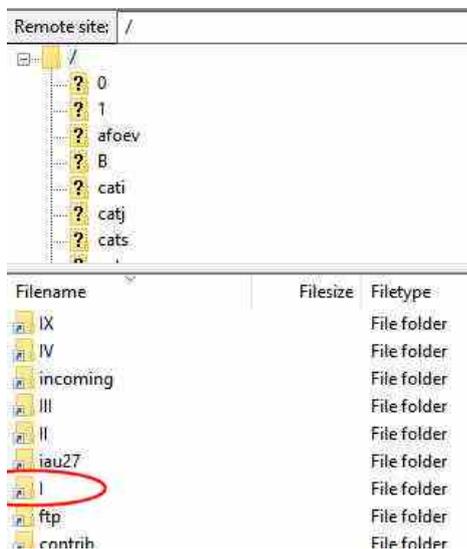
There are 908 files to be downloaded. Using FTP through a web browser will be tedious and prone to error. An easier, faster, automated, and more reliable approach is to use an FTP client to transfer the entire UCAC4 folder to your desktop computer in one step. We recommend using the free Filezilla Client software. If you don't have it, download it from <https://filezilla-project.org/>. The following recipe will apply specifically to Filezilla but probably applies similarly for other ftp clients.

Start Filezilla. First, connect to the cdsarc server. That means going into File > Site Manager, selecting New Site, and putting "cdsarc.u-strasbg.fr" in the Host field. Probably all the other settings can be defaults, certainly Logon Type is Anonymous. Dismiss any warning popup about password and files going over internet in plain text. CDS in Anonymous doesn't have a meaningful password, and these files aren't private. Click Connect, then OK, and the Remote Site (right side panel of Filezilla) should populate within a few seconds. In the menu bar at the top of Filezilla, select "Transfer > Transfer type" and make sure it is set to "Binary." *This is crucial.*

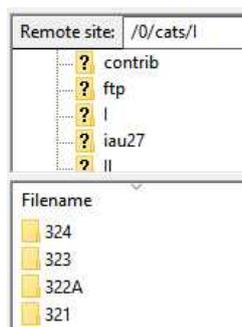
On Filezilla's left side panel find and navigate to your "User/Desktop" folder where the UCAC4 folder and all it's contents can be temporarily saved. With a few clicks through the folders, the navigation is not tricky.

Now on Filezilla's right side panel navigate to the FTP site at [cdsarc.u-strasbg.fr > pub/cats/I/322A/UCAC4/](ftp://cdsarc.u-strasbg.fr/pub/cats/I/322A/UCAC4/).

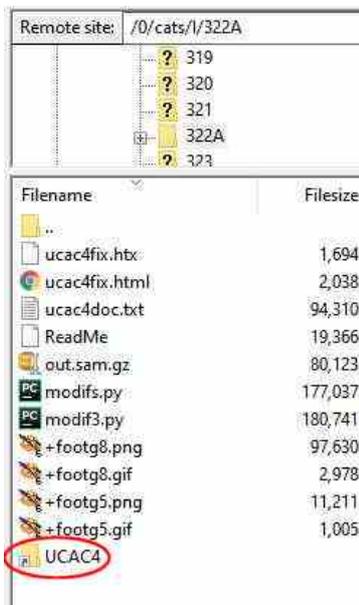
Here's what part of the right side looks like when you first connect:



Scroll down to the "I" and double click it. (That's the "I" in the site address above.) You see this next:



Then scroll down to find "322A" and double-click on it. That brings you to this place:



Stop here.

To start the transfer drag the UCAC4 folder on the right side (source) to the left desktop folder (destination) and wait. It just works--it makes all the new directories, keeps track of which files downloaded correctly and retries if necessary, reconnects if connection lost, etc. Downloading a new copy of UCAC4 can be done in background.

Finally, run the Catalog Checker, which is accessible from the Windows Start menu > PinPoint > Catalog Checker (or C:\Program Files (x86)\ACP Obs Control\Catalog Tools\CatalogChecker.exe) to validate the installation, and move the UCAC4 folder to your permanent location.

### ATLAS-REFCAT2

See [ATLAS All-Sky Stellar Reference Catalog \("ATLAS-REFCAT2"\)](#) The "original format" of this catalog as used by PinPoint consists of five magnitude "bands". Because PinPoint's API only offers Stetson {B,V,R,I} magnitudes, the Sloan {g,r,i} magnitudes are transformed to Stetson using the quadratic formulae from Kostov & Bonev [Transformation of Pan-STARRS1 gri to Stetson BVRI magnitudes\[...\]](#) arXiv:1706.06147v2 [astro-ph.IM], Section 3 and Table 2. Thus the Stetson magnitudes may fall outside the {g,r,i} magnitudes on which the bands are based. For pointing and astrometry this is not a factor.

Each magnitude band consists of 64,800 separate "square degree" files compressed into bziped tarballs (.tbz files). When expanded the bands occupy the space shown below.

Range	Size
{g,r,i} < 16	17.6 GB
16 < {g,r,i} < 17	17.9 GB
17 < {g,r,i} < 18	33.3 GB
18 < {g,r,i} < 19	58.0 GB
{g,r,i} > 19	32.2 GB

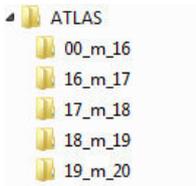
To install the catalog go to this page [ATLAS All-Sky Stellar Reference Catalog \("ATLAS-REFCAT2"\)](#) and download the magnitude bands you want. Get the "original format" data:

#### Original Format, Scaled Integer Columns

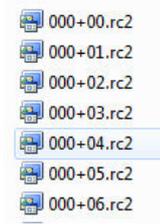
The ATLAS-REFCAT2 catalog is available in the format described in Tonry et al 2018, organized into magnitude chunks. These are compressed tarballs of 64800 CSV files for each coordinate square degree. A program [refcat.c](#) with man page [refcat.man](#) are provided by J. Tonry to Refcat2 data files in a directory and return all the stars within a distance of a given coordinate. Note this software is provided "as-is" from the author, and is not maintained by MAST.

.tbz File	Range	Size
<a href="#">hlsp_atlas-refcat2_atlas_ccd_00-m-16_multi_v1_cat.tbz</a>	{g,r,i} < 16	5.9 GB
<a href="#">hlsp_atlas-refcat2_atlas_ccd_16-m-17_multi_v1_cat.tbz</a>	16 < {g,r,i} < 17	5.6 GB
<a href="#">hlsp_atlas-refcat2_atlas_ccd_17-m-18_multi_v1_cat.tbz</a>	17 < {g,r,i} < 18	9.8 GB
<a href="#">hlsp_atlas-refcat2_atlas_ccd_18-m-19_multi_v1_cat.tbz</a>	18 < {g,r,i} < 19	17 GB
<a href="#">hlsp_atlas-refcat2_atlas_ccd_19-m-20_multi_v1_cat.tbz</a>	{g,r,i} > 19	8.7 GB

The narrower your field of view the deeper you will want the catalog to go. If you get the first three bands, covering down to mag 18, plate solving for pointing will work reliably even for narrow fields of 10 arc minutes or less. Both WinZip and WinRAR may be used to easily extract the files into the separate folders for each band. They are not free (about \$30 each). They can also be extracted with the free 7Zip archiver by following [the directions in this article](#). Various command line tools can also extract '.tbz' files. In the end you should have a top level folder ATLAS with a subfolder for each magnitude band under that:



This shows an installation with all 5 mag bands installed. The path to "the catalog" then is the path to the parent ATLAS folder. Within each of the band sub folders are exactly 64,800 "square degree" files of type .rc2. Here are the first few:



Once you have the mag bands you want installed, use the Catalog Checker to check each band separately. Note that the PinPoint User's Guide has a page that details important info regarding the magnitude bands expected to be present depending on the Plate.CatalogMaximumMagnitude setting (or if it has not been set). The best choice for most applications including SGP, ACP, FocusMax, and ACP Expert, is to install the first three magnitude bands, giving you coverage down to magnitude 18.

Last edited by Bob Denny; Apr 23, 2021 at 18:47. Reason: Clarify using original format for ATLAS

-- Bob

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