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Downloading and Using PinPoint Reference Catalogs (Updated Feb 2025)

Which reference catalog should I use?

As of Feb 2 025 We recommend against USNO A2.0 for plate solving for telescope pointing because it lacks proper motions, and this has caused solving reliability of A2.0 to decline since its release. While reading this article, keep in mind that a 1Tb (1000 Gb) portable **Solid State** USB drive is $75-ish. **What's the big deal about the full ATLAS taking 0.16 Tb**?

The short story: If you can, use ATLAS down to 18 mag. Otherwise, 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 UCAC4. The choice depends on your field of view. If it's more than 20 arc minutes, you can use the GSC.

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?

NOT ALL CATALOGS REQUIRE FTP ACCESS. ****If** your desired catalog downloads by FTP, do not attempt to use any web browser for FTP access**. 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:

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 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.]

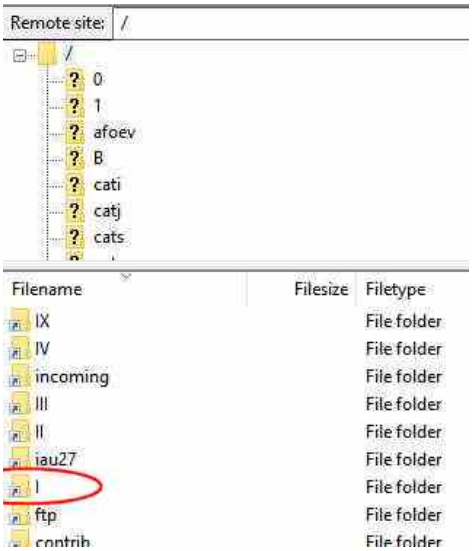
There are 908 files to be downloaded. Using FTP through a web browser will be tedious and prone to error. An easier, faster, automated, and more reliable approach is to use an FTP client to transfer the entire UCAC4 folder to your desktop computer in one step. We recommend using the free Filezilla Client 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.

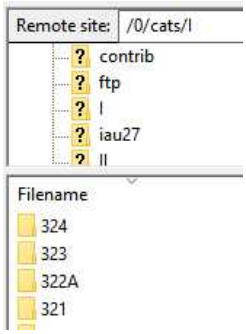
On Filezilla's left side panel find and navigate to your "User/Desktop" folder where the UCAC4 folder and all it's contents can be temporarily saved. With a few clicks through the folders, the navigation is not tricky.

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

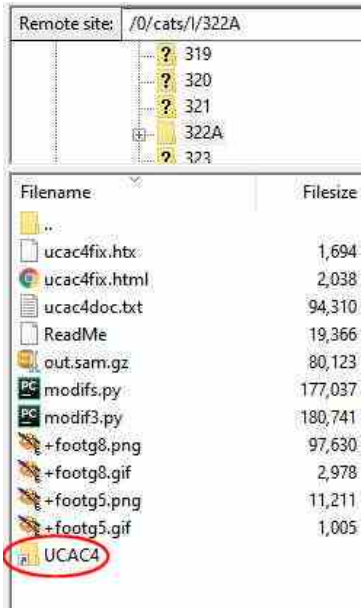
Here's what part of the right side looks like when you first connect:



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 bzipped 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

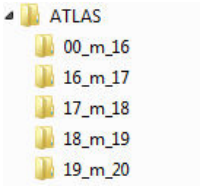
To install the catalog go to this page ATLAS All-Sky Stellar Reference Catalog ("ATLAS-REFCAT2") and download the magnitude bands you want. Get the "original format" data:

Original Format, Scaled Integer Columns

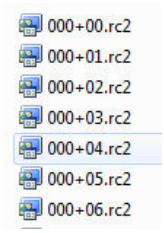
The ATLAS-REFCAT2 catalog is available in the format described in Tonry et al 2018, organized into magnitude chunks. These are compressed tarballs of 64800 CSV files for each coordinate square degree. A program refcat.c with man page refcat.man are provided by J. Tonry to Refcat2 data files in a directory 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
hlsp_atlas-refcat2_atlas_ccd_00-m-16_multi_v1_cat.tbz	{g,r,i} < 16	5.9 GB
hlsp_atlas-refcat2_atlas_ccd_16-m-17_multi_v1_cat.tbz	16 < {g,r,i} < 17	5.6 GB
hlsp_atlas-refcat2_atlas_ccd_17-m-18_multi_v1_cat.tbz	17 < {g,r,i} < 18	9.8 GB
hlsp_atlas-refcat2_atlas_ccd_18-m-19_multi_v1_cat.tbz	18 < {g,r,i} < 19	17 GB
hlsp_atlas-refcat2_atlas_ccd_19-m-20_multi_v1_cat.tbz	{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. WinRAR and WinZip may be used to easily extract the files into the separate folders for each band. They are not free (about $30). 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:



Checking the ATLAS Catalog

In 2022, it was discovered that the H and K band magnitudes in the original catalog were reversed. The data was corrected and put online. However the checksum files used by our catalog checker became invalid. Attached to this post is a zipfile containing replacements for the files in the Catalog Checker which you should use to check to see that your catalog was successfully installed. Extract and replace the files in C:\Program Files (x86)\PinPoint. Then run the catalog checker to check each band you downloaded.

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.

USNO A2.0 (no longer recommended)

This is a large catalog (6Gb), and while old, this is still good 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. It can, however, reduce solving reliability now (2023). Please consider using the ATLAS REFCAT2 (see below). If you have a solid internet connection, you can get A2.0 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://usnoa2.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.

Attached Files
CatalogChecker (2.3).zip (2.48 MB, 4521 views)

Last edited by Bob Denny; Feb 18, 2025 at 17:33. ***Reason:*** *Deprecate A2.0*

-- Bob

Quick Navigation | Application Notes - Technology, Performance, and Capabilities | Top

« Previous Thread | Next Thread »