# AAG Auto Center Plug-in
## (Version 3.02)

This program is a plug-in for Maxim DL / CCDSoft which points a TheSky-Controlled Telescope to the center coordinates of a FITS image currently opened in Maxim DL / CCDSoft and it adjusts TheSky FOVI and the camera angle (if a rotator is present) to the image roll angle (option ***Center***). It makes use of the full version of the Pinpoint Astrometric Engine which must be installed too (pinpoint.dc3.com).

Please read the sections at the end of this document which describe how to activate this plug-in for each of the imaging software.

Further, it may also be used to synchronize TheSky FOVI and the camera angle (if a rotator is present) to the roll angle of the image currently opened (option ***Synch***). Typically, one takes a picture of the sky and then selects option ***Synch*** to set the rotator angle and TheSky FVOI to the actual image roll angle.
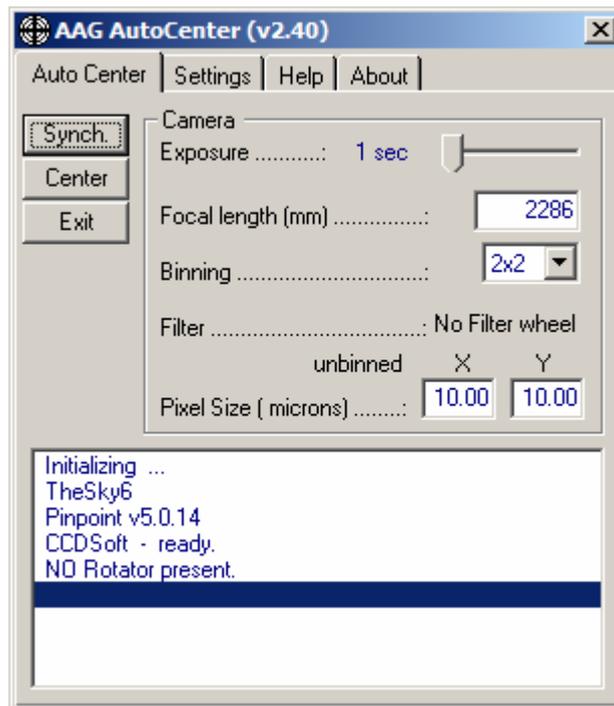


Initial screen

The program can operate with the RCOS PIR (Precision Instrument Rotator), the Optec PYXIS camera field rotator or the TAKometer rotator. Note that the use of the PYXIS rotator requires the module AAG_Pyxis v1.20 to be installed.

Upon starting, the plug-in prompts the user to define the TheSky version and the rotator to be used.
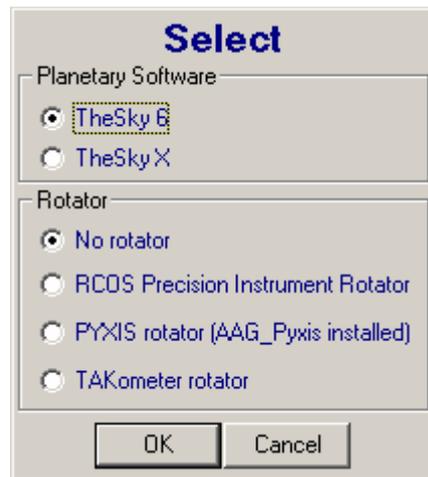


Rotator selection screen

> **Note**: When using the TAKometer option, ensure that the TAKometer Control program is running.

The program uses the information stored in the image FIT's header to determine:
- the pixel horizontal and vertical scales in arc-seconds;
- the approximate Right Ascension (RA) and Declination (Dec) of the image center;

If the information regarding the Right Ascension, Declination or pixel scales is not available from the image's header, the program will prompt the user for these values:
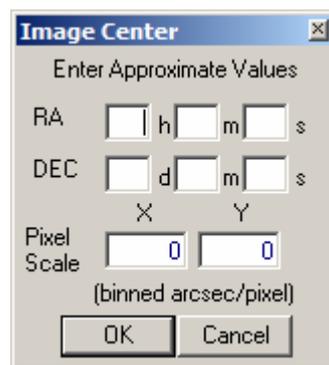


Image data screen

The pixel scale fields must contain meaningful information related to the focal distance, camera pixel size and binning factors used during the image acquisition. The CCD Calculator freeware program from Ron Wodaski may be used to determine this information http://www.newastro.com/newastro/book_new/camera_app.asp.

The program makes use of the Pinpoint Astrometric Engine to calculate the exact center of the image.

**Note:** The Pinpoint full version must be installed seeing that the version LE installed with Maxim DL, is limited in its capabilities.

The full version can be obtained from http://pinpoint.dc3.com/ and it is distributed as a shareware program with full capabilities for a 60 day trial period.
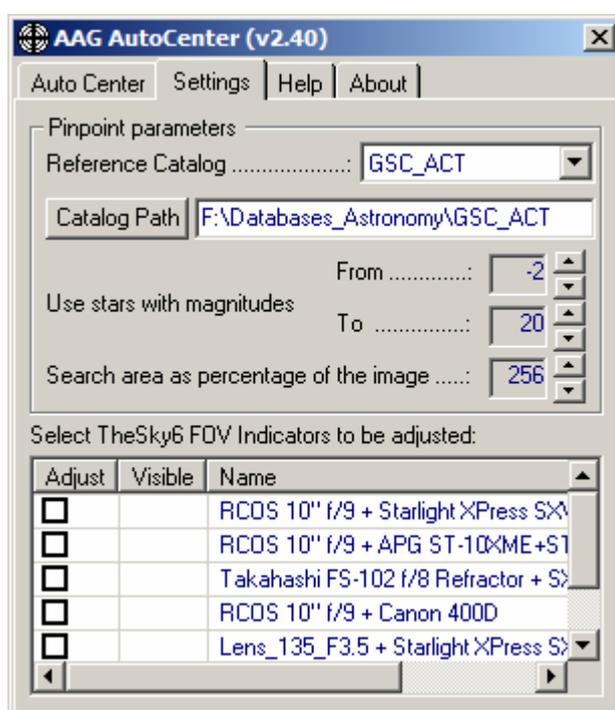


Settings Tab

The reference catalog to be used must be defined as well as the directory containing the respective catalog files.

Note: The GSC_ACT (= GSC v1.1 corrected) catalog usually produces faster results. It can be obtained via internet from http://gsc.dc3.com/ .

The path may be entered directly in the respective field or, alternatively, through the *Path* button which will display the *Select Path* window to choose the path:
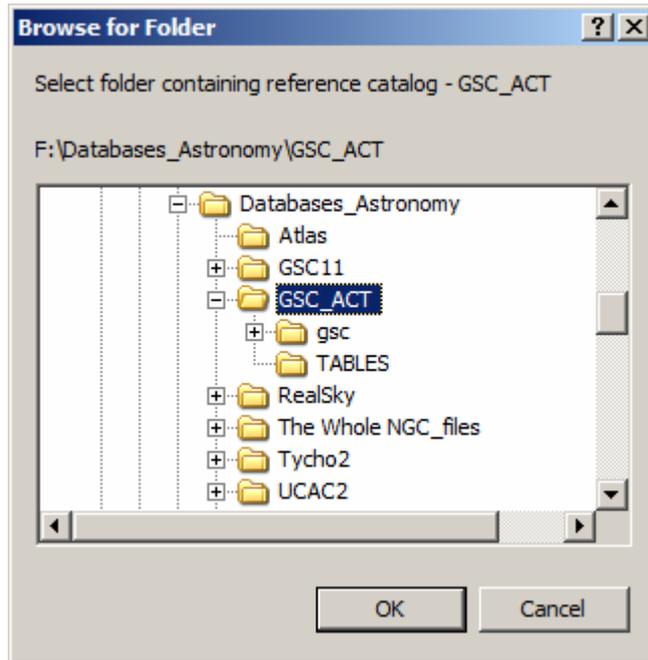
Select Path window

The default values for the magnitudes of the stars correspond to the largest range available in Pinpoint, i.e. from -2 to 20.

The default *Search Area* corresponds to the image area increased by a surrounding border corresponding to 30% of the image dimensions as illustrated below. This border dimensions can go up to a maximum of 80% of the image dimensions yielding a search area corresponding to 676% of the image area.



$\Delta w = 0.3 \times$ Image width
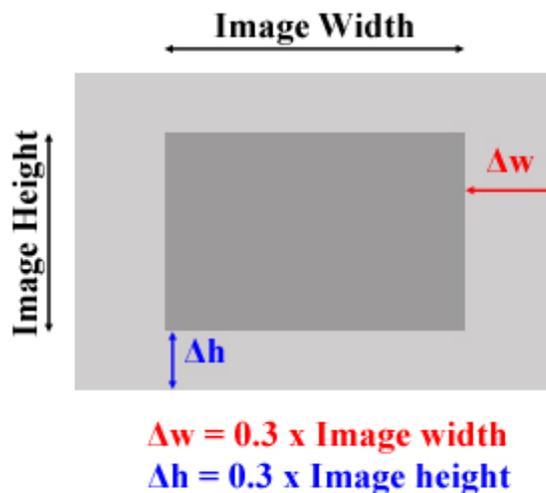$\Delta h = 0.3 \times$ Image height

Diagram illustrating the Pinpoint search
area (light gray area).

The list of all FOV indicators available in TheSky is shown. Only those which are checked (*Adjust* column) will be rotated to the angle of the image. They are selected /

deselected by clicking on the checkbox in the *Adjust* column or double-clicking on the line.

All these parameters are recorded in the file **AAG_AutoCenter.dat** in the same directory where the AAG_AutoCenter.dll file is installed and they will become the default values in the subsequent use of the program.

The positions of the different program windows are also recorded in this file.

Note that the **AAG_AutoCenter.dat** file can be deleted to reset it to the initial default values.
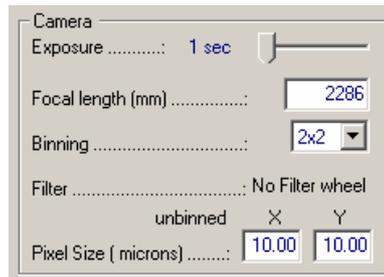


Camera parameters

The pixel size fields are initialized with values corresponding to the camera installed under the imaging software.

Note that the *Exposure* time is set to a default value of 5 seconds and it is re-adjusted to the last value set by the user.

Note that the program will default to the last filter used.

All these parameters are required by the centering operation and they do not have to be identical to those used in the acquisition of the initial image.

> It is important to note that the *Focal Length (mm)* should correspond to that of the telescope in use during the centering operation.

For the other parameters, one may use

- a higher binning factor to decrease the camera download time;
- the Luminance filter or no filter to obtain a better signal during exposure;
- a lower exposure value provided the exposure can still be resolved with Pinpoint;

The program performs the following sequence of operations when pointing the telescope to the center coordinates of an existing image:

1. The initial image is resolved with Pinpoint to obtain the exact coordinates of its center and roll angle;

2. The telescope is slewed to these coordinates;
3. An exposure is taken with the duration, the filter and the binning factor defined in the Camera parameters' fields;
4. This exposure  is resolved with Pinpoint to determine the exact center coordinates and roll angle of the camera / telescope;
5. The difference between these coordinates and those of the initial image are used to JOG the telescope to the coordinates of the initial image;
6. The selected Field Of View Indicators are rotated to the angular position of the camera.
7. The program displays the amount and direction by which the camera must be rotated manually to coincide with the same orientation as that of the initial image;

If a rotator is present and connected, the program will perform a more complete sequence of operations, namely:

1. The initial image is resolved with Pinpoint to obtain the exact coordinates of its center and roll angle;
2. The telescope is slewed to these coordinates;
3. An exposure is taken with the duration, the filter and the binning factor defined in the Camera parameters' fields;
4. This exposure  is resolved with Pinpoint to determine the exact center coordinates and  the actual roll angle of the camera / telescope;
5. The rotator and the selected Field Of View Indicators (FVOIs) are set to the roll angle of this exposure, i.e. the system is synchronized;
6. The rotator will then rotate the camera to the roll angle of the initial image and the selected FVOIs are adjusted to this angular position too.
7. Another exposure is taken after rotation;
8. This exposure is resolved with Pinpoint to obtain the exact center coordinates;
9. The difference between these coordinates and those of the initial image are used to JOG the telescope to the coordinates of the initial image.
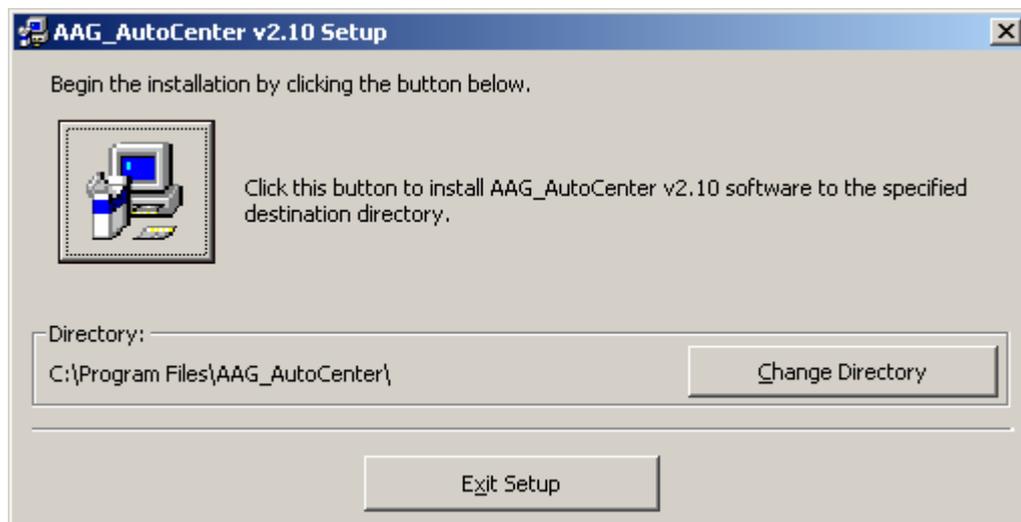
Note: A second exposure is used in Step 7 to deal with any shift caused by the rotation due to any offset between the axis of rotation and the camera CCD center.
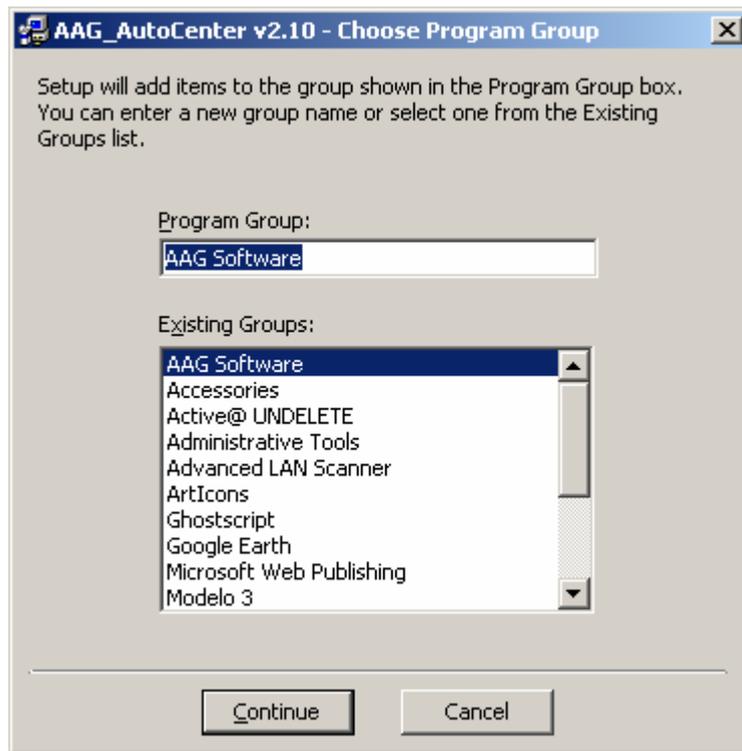
# Setup procedure

Run *Setup.exe*



Welcome screen



The default directory where the files will be installed, is
**c:\Program Files\AAG_AutoCenter\**
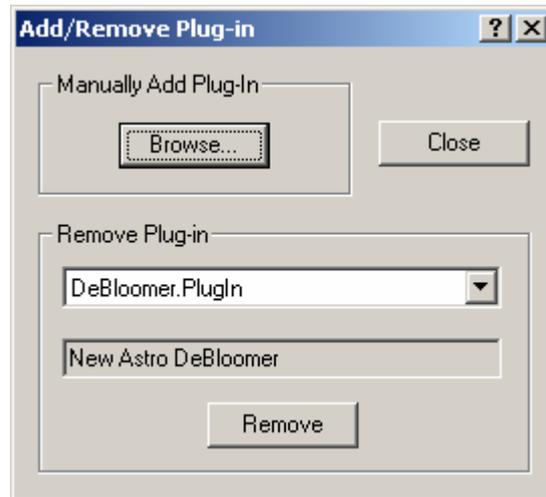
The default program group

After installation, a new menu option is available under *AAG Software* in the *Start / Programs* menu:

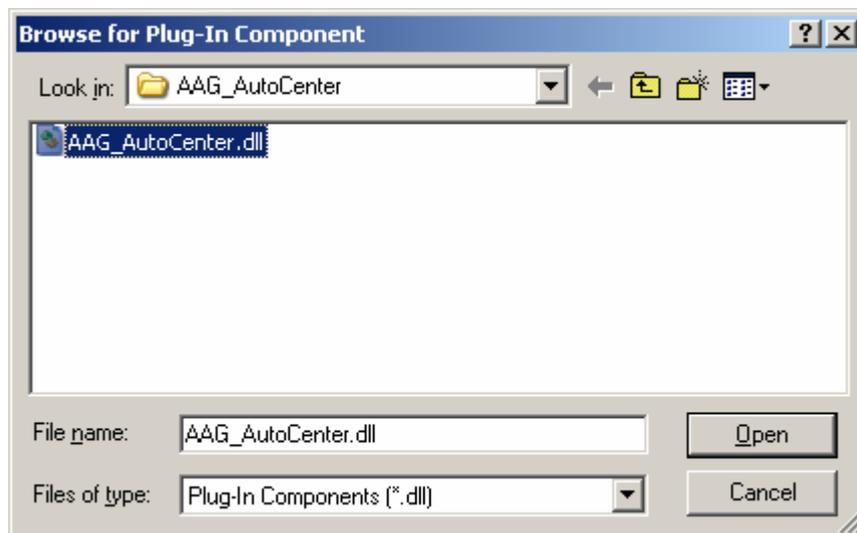- *AAG_AutoCenter v3.02  Information*

# Activate Plug-in in MAXIM DL

To activate the plug-in in Maxim DL, choose *Add/Remove Plug-in…* under menu option

*Plug-in   /   Add/Remove Plug-in…*



Click *Browse* Button and choose the **AAG_AutoCenter.dll**



The **AAG_AutoCenter** plug-in becomes available in Maxim DL menu option *Plug-in*.

If you re-installing a new version of this plug-in, it is advisable to explicitly remove it using option *Remove* of menu option *Plug-in / Add/Remove Plug-in …*and then repeat the steps above mentioned. This will update the plug-in name displayed in the Maxim DL menu.
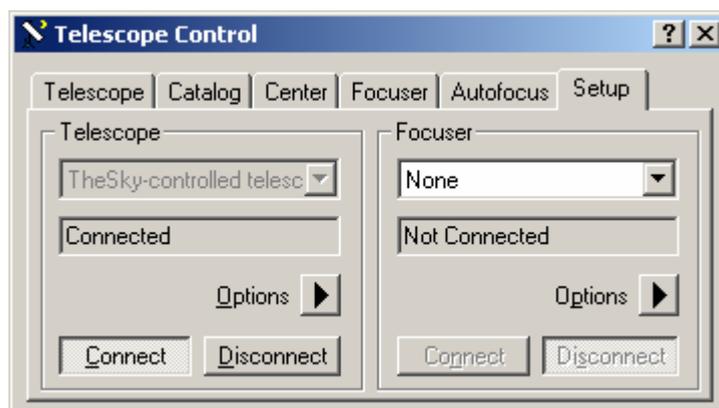
**Important note regarding Maxim DL parameters:**

Maxim DL attaches automatically the RA, DEC and telescope focal distance information to the image FITS header provided that:

- the telescope focal distance is defined under Site & Optics (menu option File/Settings …) ;
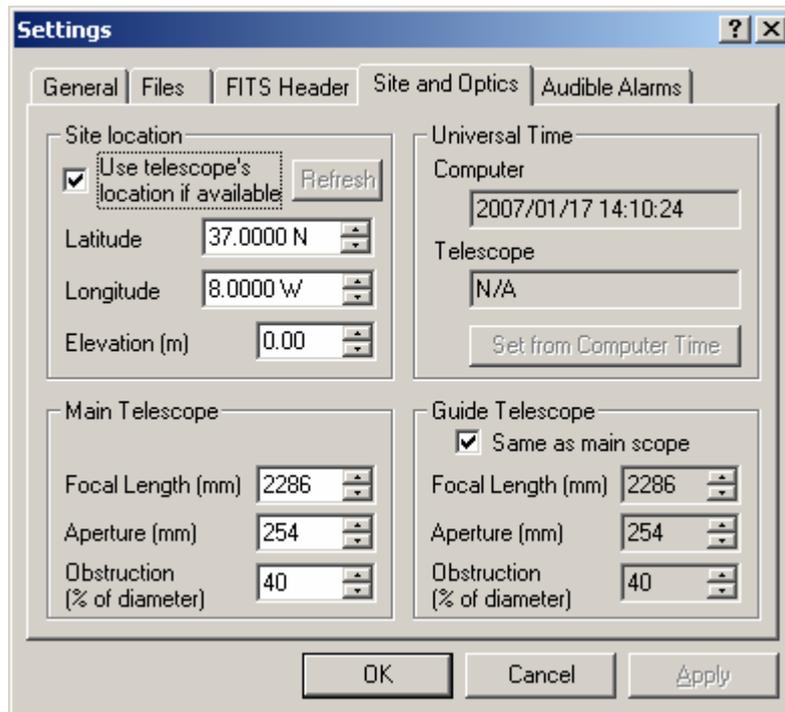


- Maxim DL is connected to TheSky in the Telescope Control window;



It is good practice to keep these options set during any imaging session.

# Activate Plug-in in CCDSoft

To activate the plug-in in CCDSoft copy file **AAG_AutoCenter.dll** from the directory where it was installed, by default this directory is

*C:\Program Files\AAG_AutoCenter*,

to the sub-directory named

*Image Processing Plug Ins*

located in the CCDSoft directory. The default CCDSoft directory is

*C:\Program Files\Software Bisque\CCDSoft Version 5*

After using the plug-in for the first time, the file containing the default values (i.e. file *AAG_AutoCenter.dat*) is created in this directory.

**Important note regarding CCDSoft parameters:**

Check under menu option *File / Preferences …* that the correct option regarding the TheSky version in use is selected. If this option is not correctly selected, the images' headers will not contain the coordinates of the center of the image in terms of Right Ascension & Declination.
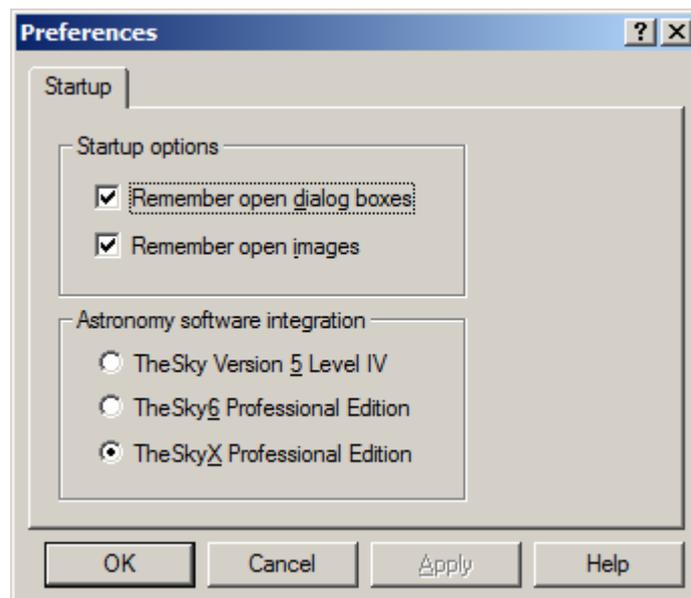


Define the focal telescope distance under option *File Defaults …* available in the *Setup* TAB of the *Camera Control* window.
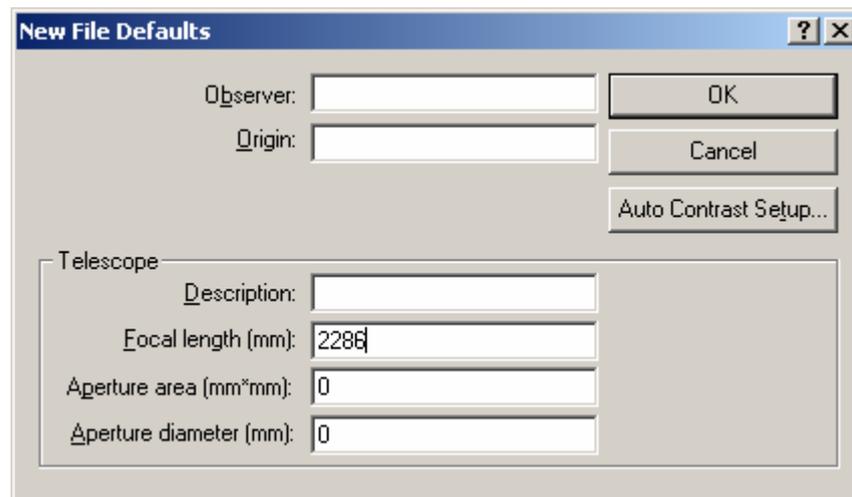
Check under menu option *Camera / Server Settings …* that the following options are selected:

- *Allow exposures*
- *Allow temperatures regulation*
- *Allow filter Control*

If these options are not enabled, the plug-in will not be able to communicate with CCDSoft giving rise to error messages.