

Double Star Observations

Canopus now includes enhanced features for measuring double stars. This includes easier setting of the reference position (the primary star) as well as recording the observations and being able to generate complete or summary reports. The summary reports can even reduce the saved raw instrumental magnitudes in different filters into standard magnitudes, greatly increasing the scientific value of your observations.

The Users Guide contains tutorials on using the new features. In brief you would

1. Use the Double Stars List to select all the images you want to measure. This List is easier than having to use the Image | Open and locating the next file after each measurement.
2. For each image, specify the reference (primary) star, specify the secondary star, and then add the information to the DoubleStarsManagement table in <MPOROOT>\COMMON.
3. After all images have been measured, use the Double Stars Measurements form to review the data and generate a report of the raw information for all data or that matching a name and/or date range, or a summary report that can combine observations of a given star/filter/date into a single observation with errors and reduced standard magnitudes.

How Double Stars Are Measured

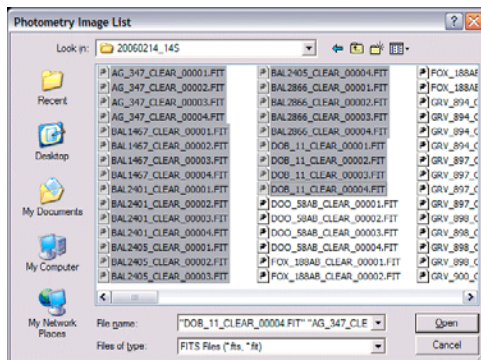
When you do an AutoMeasure for an image, this generates a set of "plate constants" that allow converting an X/Y position to RA/Declination. Canopus stores the measured RA/Declination for the primary and secondary and then computes the distance and position angle using standard formulae found in "Astronomical Algorithms" by Meeus and "Observing and Measuring Visual Double Stars" by Argyle.

This is a more rigorous method than simply computing the X/Y positions and applying plate scales (arcsec/pixel) to find the distance since it also accounts for the $\cos(\text{Declination})$ factor in the RA and positions near the pole.

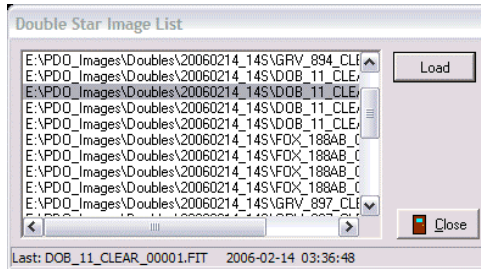
Setting the Double Stars List

The first step to using the Double Stars List is to select one or more images to be measured

1. Make sure the configuration settings for rows/cols and pixel sizes match the images you're about to measure. This is because the Double Stars List automatically invokes the AutoMeasure routine immediately after an image is loaded.
2. Use Utilities | Double Stars | Set double star list (or Ctrl+L hot key) to open a file selection dialog.



3. Select those files you want to measure and then click Open. This displays the Double Stars List.



4. Double click on the first file in the list. This loads the image into Canopus. Each time an image is loaded, the highlight automatically moves to the next item in the list so that once you've measured the just selected image, you can quickly load the next image in the list.

As each image is loaded, Canopus automatically invokes the AutoMeasure routine. If a match is made, you'll see numbers beside stars in the chart. If the numbers do not appear, then the AutoMeasure routine was not able to make a match. In this case, use the manual method of matching the chart to the image.

5. Once the image is matched, click on the primary star on the image. If you hold down the Alt key before you click this prevents the ObjectInfo box from appearing. This contains information about the star on which you just clicked. If you don't hold down the key, simply press the ESCAPE key to clear the ObjectInfo box before moving on.

6. Then right-click over the image and select "Set Dist/PA reference" from the popup menu.

7. Click on the secondary star. Again, hold down the Alt key before clicking to avoid displaying the ObjectInfo box.

8. Right-click over the image and select "Save Dist/PA Data" from the popup menu to display the Double Stars Input form.

9. When you save the observation, Canopus can automatically load the next image in the Double Star List or you can load it manually. This depends on the state of checkbox on the Double Stars List form.

10. Repeat the steps above until the last image has been measured.

Adding Double Stars Data

The Double Stars Input form (see step #9) in the previous section displays the information recorded by Canopus. Some of the data can be changed but most cannot.

Double Star Data			
JD	2453780.94206	UT	2006/02/14 10:36:34
Name	DOB 11	Filter	C
Primary		Secondary	
RA	14:54:11.20	RA	14:54:08.57
Dec	+ 9:30:54.1	Dec	+ 9:30:53.5
Mag	-12.538	Mag	-11.091
AM	1.251		
		Dist (")	39.013
		P.A. (")	269.116

JD (read only)

This is the Julian Date of mid-exposure as determined by reading the image FITS/SBIG header.

UT (read only)

The calendar date and time (UT) corresponding to the Julian Date above. It is not corrected for heliocentric JD.

Name

Enter the name of the primary. This is usually the WDS catalog entry for this double star. **This field cannot be blank.**

Filter

Select the filter used for the observation. The options are the standard photometry filters, excluding U, i.e., BVRIC(lear)

Primary Data

- RA (read only) The measured RA of the primary star after doing an image match and finding the plate constants for the image.
- Dec (read only) The measured Declination of the primary star after doing an image match and finding the plate constants for the image.
- Mag (read only) The instrumental magnitude of the primary star
- AM (read only) The air mass of the field based on the measured RA/Dec of the primary star, the configuration settings for longitude and latitude and the corrections for image mid-exposure. This information is used in the summary reports when applying PhotoRed transforms and first-order extinction values.

Secondary Data

- RA (read only) The measured RA of the secondary star after doing an image match and finding the plate constants for the image.
- Dec (read only) The measured Declination of the secondary star after doing an image match and finding the plate constants for the image.
- Mag (read only) The instrumental magnitude of the secondary star
- Dist (read only) The computed distance of the secondary from the primary using the measured RA/Dec of each star.
- PA (read only) The position angle of the secondary from the primary, with 0° being North, 90° being East, etc. The value is computed using the measured RA/Declination of the two stars.

Load DS List Image

Check this box to have Canopus automatically load the next image in the Double Stars List when you click OK (or press Enter since the OK button is the default control). If this box is not checked, you must manually load the next image using the Load button on the Double Stars List form or using Image | Open from the Canopus main menu.

This checkbox is disabled if the Double Stars List form is not open.


In most circumstances, you want this box checked, which is the default, when using the Double Stars List. The exception would be when you have a multiple star on a set of images, e.g., an AB, AC, and BC pair. In this case, uncheck the box so that when you add a measurement, the current image remains loaded with its astrometric solution still valid.

For example, if you set the A star as the reference and measured the B as the secondary, you can then measure the C component as the secondary without having to reset the A as the reference. Just be sure to change the entry in the Name field to match which pair is being measured. For the B-C pair, you would have to reset the B star as the reference and the C as the secondary.

One you move to a new set of images with just a primary-secondary pair, check the box so that Canopus automatically loads the next image in the Double Stars List.

OK

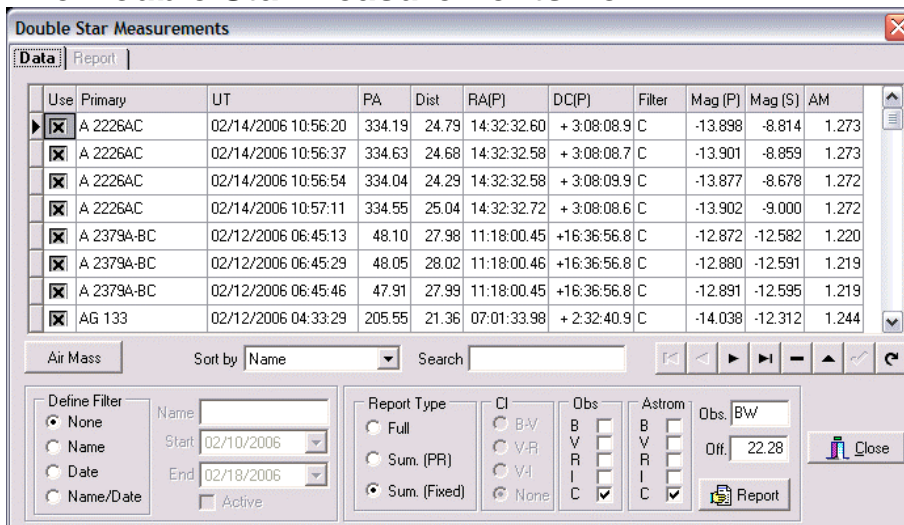
Click this button to add the data to the DoubleStarMeasurement table. A confirmation beep is played if the data is added to the table. Use the Double Star Measurements form to review the data and generate observation reports.

 If the Double Stars List is open, then clicking OK (and then OK on the confirmation message) on this form sends a message to the Double Stars List so that the next image in the list is automatically loaded and measured, i.e., it's as if you immediately clicked the Load button on the Double Stars List form. See the discussion above under "Load DS List Image."

Cancel

Click this button to close the form without adding the data to the DoubleStarMeasurements table.

The Double Star Measurements Form



Use	Primary	UT	PA	Dist	RA(P)	DC(P)	Filter	Mag (P)	Mag (S)	AM
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:56:20	334.19	24.79	14:32:32.60	+ 3:08:08.9	C	-13.898	-8.814	1.273
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:56:37	334.63	24.68	14:32:32.58	+ 3:08:08.7	C	-13.901	-8.859	1.273
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:56:54	334.04	24.29	14:32:32.58	+ 3:08:09.9	C	-13.877	-8.678	1.272
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:57:11	334.55	25.04	14:32:32.72	+ 3:08:08.6	C	-13.902	-9.000	1.272
<input checked="" type="checkbox"/>	A 2379A-BC	02/12/2006 06:45:13	48.10	27.98	11:18:00.45	+16:36:56.8	C	-12.872	-12.582	1.220
<input checked="" type="checkbox"/>	A 2379A-BC	02/12/2006 06:45:29	48.05	28.02	11:18:00.46	+16:36:56.8	C	-12.880	-12.591	1.219
<input checked="" type="checkbox"/>	A 2379A-BC	02/12/2006 06:45:46	47.91	27.99	11:18:00.45	+16:36:56.8	C	-12.891	-12.595	1.219
<input checked="" type="checkbox"/>	AG 133	02/12/2006 04:33:29	205.55	21.36	07:01:33.98	+ 2:32:40.9	C	-14.038	-12.312	1.244

The Double Star Measurements form displays all observations that you've recorded using the Save Dist/PA Data item on the Image popup menu and displayed in the Double Stars Input form. With this form, you can delete records but not add new records. You can edit some of the data "in situ" for a given record.

This form has a minimum size to assure that all controls remain visible. However, it can be expanded to make viewing the report easier. The previous size and position of the form are restored each time the form is opened.

This section describes the data and basic operation of the form. See "Generating Double Star Reports" below for details on creating reports based on the data filters and other settings on the form.

Data Table

Displays the principal data for each observation. Additional data is recorded and included when a report is generated. The data in four columns can be edited

- Use If checked, the observation is included in the summary reports. All observations are always included in the Full report.
- Primary The name for the double pair. As seen in the screen shot above, the name can

be used to indicate specific pairs in a multiple star system. A maximum of 20 characters is allowed.

- | | |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Filter | When the cell is active, a drop down list can be used to set the filter for a given observation. |
| AM | The air mass for the observation. If the configuration settings for longitude, latitude, and for computing mid exposure were not correct when adding the data initially, this can be corrected by setting the configuration correctly and then clicking the Air Mass button. This computes the air mass for all observations, not just those |

Sort by

Select the order by which the observations are sorted. The options are

- RA
- Name (primary)
- Julian Date

Search

Enter the initial or complete text for which to search records, based on the current sort order. When sorting by JD, you must enter the Julian Date, not the calendar date and time.

Define Filter

Select one of the radio group items to filter the data by name and/or date. Only that data included with a filter is included in a report.

- | | |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| None | All records are displayed/included |
| Name | Include only those records where the name of the primary matches the entry in "Name" exactly. The filter is case-sensitive and does not include partial matches. For example: if you enter "Test", then "Test 1" would not be included since it's not an exact match, nor would TEST since it's upper case while the filter is mixed upper/lower case. |
| Date | Includes only those records between the start and end dates, inclusive. To include only one date, set Start and End to the same calendar date. The drop down lists display a calendar that lets you pick the date or you can enter it in the field directly. The End Date must be equal to or greater than the Start Date. |

Name/Date Includes only those records that mach the Name **and** Date range.

Active

Check this box to invoked the filter (not available if None is selected). Uncheck the box to remove the filter, which has the effect of selecting None but leaves the box enabled so you can use the filter again without redefining it.

If you change the entry in Name or the two date range controls, the Active box is automatically unchecked, i.e., the filter is no longer applied. This forces a check of the new filter parameters, which is done every time the Active box is checked.

Report

Click this button to generate a report based on the current filter and sort order.

- | | |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Full | Includes all raw data for all stars within the data filter, even those with the Use flag not checked. |
| Summary (PR) | Creates a summary report within the data filter that reduces the instrumental magnitudes to standard magnitudes based on transforms and first order extinction values found in PhotoRed. |

Summary (Fixed) Creates a summary report within the data filter that applies a fixed value to all instrumental magnitudes. This value can be determined from the Binzel Method in PhotoRed or other means. The report can be generated only one filter at a time since the offset between instrumental and standard magnitudes is likely different for each filter.

CI

The color index used for a Summary (PR) report. This group is disabled if the report type is Full or Summary (Fixed). In the latter case, the CI method is forced to "None".

Obs

Check the boxes for those filters for which you have observations and want to be included in the summary report. If using the Summary (PR) report, you must include the filters used for the selected color index (if not NONE).

Astrom

Check those boxes for those filters for which you want the observations used to determine the distance and position angle of the secondary star. If you select a filter in this group, then it must also be selected in the Obs group. For faint stars, where the SNR is not as high, you may want to use only Clear observations for astrometry.

Obs

Enter the initials of the observer for the stars included in the report. Usually this is two letters - the first/last name initials. In some cases, a three letter code may be assigned by the USNO and that would be entered instead. A maximum of five characters is allowed.

Offset

Enter a fixed offset to be applied to all raw instrumental magnitudes in the Summary (Fixed) report. Using this approach assumes no corrections for color index or extinction.

Report

Click this button to generate the selected report.


The Double Star Measurements form allows generating one of three types of reports.

Fixed Report	This shows the raw data for all observations matching the data filters (if any). Otherwise, the other options to filter data, e.g., the Obs and Astrom filter settings are ignored.
Summary (PR)	This report uses the data filters of name and/or date along with the settings in the CI (color index), Obs, and Astrom group settings. Transforms and first order extinction values found in PhotoRed are applied to the raw instrumental magnitudes to produce standard magnitudes included in the report. See below for how data is summarized.
Summary (Fixed)	This report uses the data filters of name and/or date, the fixed offset value in "Off.", and the Obs and Astrom group settings. The fixed offset is applied to the raw instrumental magnitudes to generate a standard magnitude. This does not include transforms or first order extinction corrections. See below for how data is summarized.

Double Stars – Generating A Report

The Double Star Measurements form allows generating one of three types of reports.

Fixed Report	This shows the raw data for all observations matching the data filters (if any). Otherwise, the other options to filter data, e.g., the Obs and Astrom filter settings are ignored.
Summary (PR)	This report uses the data filters of name and/or date along with the settings in the CI (color index), Obs and Astrom group settings. Transforms and first order extinction values found in PhotoRed are applied to the raw instrumental magnitudes to produce standard magnitudes included in the report. See below for how data is summarized.
Summary (Fixed)	This report uses the data filters of name and/or date, the fixed offset value in "Off.", and the Obs and Astrom group settings. The fixed offset is applied to the raw instrumental magnitudes to generate a standard magnitude. This does not include transforms or first order extinction corrections. See below for how data is summarized.

 **The two summary reports should provide all the information needed for publication, included errors (standard deviations) and the values used to reduce to standard magnitudes.**


Setting the Data Filters

All reports honor the settings within the Define Filter group.

1. Select an option in "Define Filter".

None	Includes all records
Name	Includes those records matching the value in the "Name" field. The filter is case-sensitive, i.e., 'AG' and 'ag' are not the same Also, the match must be exact, i.e., you cannot use partial matches, e.g., all stars starting with 'AG'
Date	Enter the start and end calendar dates. The Start date must be equal to or before the End date. The dates are for midnight on the specified date, so to include observations made after midnight, set the End date to one day later. For example, if you made measurements on Feb. 14, 2006 at 07:00 UT, you should set the End date to Feb. 15, 2006.
Name/Date	Combines the Name and Date filters, meaning you could specify all observations for a given star during a given month or year.

2. Check the Active check box to see the results of the filter settings. The report is somewhat WYSIWYG, meaning only those records that appear in the data table when you click the Report button will be considered for inclusion in the report.

 **Remember that the USE flag is ignored for the Full report, which includes a column to show if the USE flag is checked or not. The summary reports consider only those records where the USE flag is checked.**

How A Summary Report is Generated

When running a summary report, two initial steps are always taken

1. Load the data for all observations for which the USE box is checked and are within the data filters of name and/or date range.

2. Sort the data by Name and JulianDate in ascending order, i.e., in the case of observations with the same primary name, the "tie-breaker" is the Julian Date.

In the following, "each observation" means that the primary and secondary are both handled independently

3. Iterate through the records.
 1. Find the first record for a given name. The associated JD is the "base value" for group. All observations with the same name and having a JD within 0.5d of the base value are placed into the same group for summarizing observations.
 2. All observations within the name/JD group are placed into subgroups based on the filters selected in the Obs group. A separate tabulation is kept for all observations within the name/JD group that match the Astrom filter settings.
 3. If the report type is Summary (PR), a check is made to see that there is a least one observation in each of the filters indicated by the CI selection (unless the selection is NONE, in which case the test is forced to succeed).
 4. If the test succeeds, the color index is computed:

If Summary (PR) and the color index setting is not NONE, the mean instrumental values are computed for the two required filters and corrected for first order extinction. The difference between the instrumental magnitudes is then corrected to a standard color index, e.g., b-v to B-V using values read from PhotoRed's Transforms data.

If Summary (Fixed), the color index is set to 0.0. This allows the same basic formula to be applied to the raw instrumental magnitudes regardless of the summary report type.
 5. The mean instrumental magnitude and standard deviation for each subgroup of observations based on filter is computed.
 6. The first order extinction values are applied to the mean instrumental values and then corrected to standard magnitudes using the color index found in step 4 and the transforms values from PhotoRed.
 7. The summary data is written for each observation.
4. After all the records have been processed, the mean and standard deviations of the distance and position angle values that were maintained independently of the instrumental magnitude reductions are found. This data is added to the summary line for the given primary/secondary pair. Since the distance and position angle are maintained independently, the values are duplicated for each name/JD summary line, regardless of filter, i.e., the distance and separations are not maintained no reported by filter but all specified observations are "lumped" into a single data set.

Generating a Fixed Report

See Generating a Report for a discussion on how reports are generated and setting the options in the "Define Filter" section.

Steps for Generating a Full Report

1. Set the options in the "Define Filter" section as desired.
2. Select "Full" for the report type. This forces the CI group to be disabled and set to "NONE".
3. Select the filters in the Obs group for which you want to include the observations. For example, in the screen shot above, only those observations made with the C filter will be included. You can select more filters than you select in the Astrom group.
4. Select the filters in the Astrom group for which you want the observations to be used to calculate the distance and position angle of the double star. For each filter selected here, you

must have the same filter selected in the Obs group.

5. Set the Obs field with the initials of the observer who made the measurements. If more than one person, generate a separate report for each observer.
6. Click the report button. Once the report is generated (assuming at least one observation is found), the form switches to the Report page to display the report.

Obs	Name	UT	JD	Epoch Julian	Dist	PA	P
Y	AG 133	02/12/2006 04:33:29	2463778.69993	2006.116	21.36	206.66	
Y	AG 133	02/12/2006 04:33:46	2463778.69011	2006.116	21.37	206.48	
Y	AG 133	02/12/2006 04:34:00	2463778.69028	2006.116	21.36	206.50	

The report can be edited, but use caution to save the formatting of the lines.

Save

Click this button to save any changes you make to the report. A file save dialog appears where you can choose to save the file under the same or different name. The file is saved and then the report is reloaded to confirm that the changes were recorded.

Generating a Summary (PR) Report

See Generating a Report for a discussion on how reports are generated and setting the options in the "Define Filter" section.

Use	Primary	UT	PA	Dist	RA[P]	DCP[P]	Filter	Mag[P]	Mag[S]	AM	
<input checked="" type="checkbox"/>	A	2226AC	02/14/2006 10:56:20	334.19	24.79	14.32:32.60	+ 3.08:09.9	C	-13.890	-8.814	1.273
<input checked="" type="checkbox"/>	A	2226AC	02/14/2006 10:56:37	334.62	24.88	14.32:32.58	+ 3.08:09.7	C	-13.901	-8.858	1.273
<input checked="" type="checkbox"/>	A	2226AC	02/14/2006 10:56:54	334.04	24.29	14.32:32.58	+ 3.08:09.9	C	13.877	-8.678	1.272
<input checked="" type="checkbox"/>	A	2226AC	02/14/2006 10:57:11	334.55	25.04	14.32:32.72	+ 3.08:09.6	C	-13.902	-9.000	1.272
<input checked="" type="checkbox"/>	A	2379A-BC	02/12/2006 06:45:13	48.09	27.98	11.18:00.45	+16.36:56.8	C	-12.872	-12.582	1.220
<input checked="" type="checkbox"/>	A	2379A-BC	02/12/2006 06:45:29	48.05	28.02	11.18:00.45	+16.36:56.0	C	-12.880	-12.591	1.219
<input checked="" type="checkbox"/>	A	2379A-BC	02/12/2006 06:45:46	47.91	27.99	11.18:00.45	+16.36:56.8	C	-12.891	-12.596	1.219
<input checked="" type="checkbox"/>	AG	133	02/12/2006 04:33:29	206.95	21.36	07.01:33.98	+ 2.32:40.9	C	14.038	12.312	1.244

Steps for Generating a Summary (PR) Report


1. Confirm the settings in the PhotoRed Transforms form for:

First Order Extinction for each filter to be included in the Obs group selection

Color Index for two filters to be included in the Obs group selection (if the CI group is not set to NONE). These must be either B and V, V and R, or V and I.

Transforms (slope and zero point) for each filter to be included in the Obs group selection

The "Hidden" transforms for the color index selected in the CI group. These convert instrumental magnitude color indices to standard magnitudes indices.

 **The Transforms values must have been determined using the same color index that you select in the CI group below.**

2. Set the options in the "Define Filter" section as desired.
3. Select "Summary (PR)" for the report type.
4. Select the CI filter combination. If NONE, the color index corrections values are forced to 0.0 (no correction). However, the transforms and first order corrections will still be applied.
5. Select the filters in the Obs group for which you want to include the observations. For example, in the screen shot above, observations made with the V, R, and C filters will be included. The first two are required since the V-R color index was selected. You can select more filters than you select in the Astrom group.
6. Select the filters in the Astrom group for which you want the observations to be used to calculate the distance and position angle of the double star. For each filter selected here, you must have the same filter selected in the Obs group.
7. Set the Obs field with the initials of the observer who made the measurements. If more than one person, generate a separate report for each observer.
8. Click the report button. Once the report is generated (assuming at least one observation is found), the form switches to the Report page to display the report. See Double Stars - Summary (Fixed) Report for a sample of the report.

Generating a Summary (Fixed) Report

The screenshot shows the 'Double Star Measurements' software interface. At the top is a table with columns: Use, Primary, UT, PA, Dist, RA(P), DC(P), Filter, Mag(P), Mag(S), AM. Below the table are control panels for 'Define Filter', 'Report Type', 'Obs', and 'Astrom'. The 'Define Filter' panel has 'None' selected. The 'Report Type' panel has 'Sum (PR)' selected. The 'Obs' panel has 'V', 'R', and 'C' filters selected. The 'Astrom' panel has 'C' selected. A 'Report' button is visible at the bottom right of the control panels.

Use	Primary	UT	PA	Dist	RA(P)	DC(P)	Filter	Mag(P)	Mag(S)	AM
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:56:20	334.19	24.79	14.32:32.60	+ 3:00:00.9	C	-13.099	-0.014	1.273
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:56:37	334.63	24.68	14.32:32.58	+ 3:08:08.7	C	-13.901	-8.859	1.273
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:56:54	334.04	24.29	14.32:32.58	+ 3:08:09.9	C	-13.977	-8.678	1.272
<input checked="" type="checkbox"/>	A 2226AC	02/14/2006 10:57:11	334.55	25.04	14.32:32.72	+ 3:00:00.6	C	-13.902	-9.000	1.272
<input checked="" type="checkbox"/>	A 2379A-BC	02/12/2006 06:45:13	48.09	27.98	11:18:00.45	+16:36:56.8	C	-12.872	-12.582	1.200
<input checked="" type="checkbox"/>	A 2379A-BC	02/12/2006 06:45:29	48.05	28.02	11:18:00.45	+16:36:56.0	C	-12.890	-12.591	1.219
<input checked="" type="checkbox"/>	A 2379A-BC	02/12/2006 06:45:46	47.91	27.99	11:18:00.45	+16:36:56.8	C	-12.891	-12.595	1.219
<input checked="" type="checkbox"/>	AS 133	02/12/2006 04:33:29	209.95	21.36	07:01:33.98	+ 2:32:40.9	C	-14.038	-12.312	1.244

See Generating Reports for a discussion on how reports are generated and setting the options in the "Define Filter" section.

Steps for Generating a Summary (PR) Report

1. Set the options in the "Define Filter" section as desired.
2. Select "Summary (Fixed)" for the report type. This forces the CI group to NONE and disables it.
3. Select the one and only one filter in the Obs group for which you want to include the observations. For example, in the screen shot above, observations made with the C filters will be included. You must run a separate report for each filter since the value in the "Off" field is very likely different for each filter.
4. Select the same filter in the Astrom group that you selected in the Obs group.
5. Set the Obs field with the initials of the observer who made the measurements. If more than one person, generate a separate report for each observer.
6. Enter the offset value to be applied to the raw instrumental magnitudes. This should always be 0.0 or a positive number. If you enter 0.0, the raw instrumental magnitudes are reported. A typical value for the V filter is in the range of 20.0-23.0.



This value can be determined by using the first step of the Binzel Method in PhotoRed, where you measure a field and find the average of the differences between the instrumental magnitude and the standard magnitude for a number of reference stars.

- Click the report button. Once the report is generated (assuming at least one observation is found), the form switches to the Report page to display the report.

Name	RA	Dec	Fil	Mags	PA	Sep	Epoch	N	Obs
A 2226AC	11 10	+16 37	C	8.9,10.4	334.4	24.70	2006.122	4	BW
A 2279B-BC	07 01	+02 33	C	9.3,9.6	48.0	20.00	2006.116	3	BW
AG 133	04 45	+19 11	C	8.2,9.9	205.5	21.36	2006.116	3	BW
AG 111AB	14 37	+11 02	C	8.3,8.6	112.1	33.01	2006.118	3	BW
AG 346	18 23	+11 22	C	8.8,9.9	387.2	26.14	2006.122	4	BW
AG 347	04 10	+36 18	C	9.4,10.8	10.9	24.42	2006.122	3	BW
AG 78	04 42	+06 30	C	9.8,10.0	199.1	18.01	2006.118	6	BW
AG 81	04 55	+08 24	C	9.8,10.1	279.8	38.66	2006.118	3	BW
AGC 27	07 00	-02 16	C	10.4,10.6	149.4	36.89	2006.118	3	BW
BAL 104	07 01	-02 47	C	12.2,12.0	166.1	11.50	2006.118	3	BW
BAL 105	07 00	+00 34	C	12.0,10.8	129.5	18.58	2006.116	3	BW
BAL 1066	07 00	+00 29	C	10.6,12.0	88.3	19.89	2006.118	3	BW

Note the second line of the report. This indicates the color index correction values that were applied. In a FIXED report, the slope is always 0 and the Offset is the value.

The third line contains the First Order extinction values from PhotoRed.

The fourth line contains the Transforms that convert instrumental magnitudes to a standard filter. The first value for each filter is the color index dependency while the second is the zero point offset.



In the case of the Summary (PR) report, the Transforms values must have been determined using the same color index that you selected in the CI group.

The report will be sorted first by name, then date, then filter. In the example above, all observations were made using the same filter. There are more columns than appear in the screen shot above. They are:

Primary Data Columns

Name	Name of the double star pair assigned when adding data using the Double Star Input form.
RA/Dec	The approximate J2000 position of the primary star in the pair.
Fil	The filter used
Mags	The reduced magnitudes, unless FIXED and Offset = 0.0. In that case, the raw instrumental magnitudes are reported.
PA	The average position angle
Sep	The average distance, in arcseconds.
Epoch	The Julian Epoch, rounded to the nearest 0.001yr (0.36525d)
NA	The number of observations used to find the average for the distance and position angle values.
NF	The number of observations used to find the average instrumental magnitude in the given filter.
Obs	The observer entered in the Obs field on the Data page
CIP	The reduced color index of the primary

CIS The reduced color index of the secondary

Errors Columns

PSD The standard deviation of the position angle, in degrees

DSD The standard deviation of the separation, in arcseconds

CIPSD The standard deviation of the primary's color index as computed by averaging the raw instrumental magnitudes in the appropriate filters.

CISSD The standard deviation of the secondary's color index as computed by averaging the raw instrumental magnitudes in the appropriate filters.

MPSD The standard deviation of the primary's reduced magnitude.

MSSD The standard deviation of the secondary's reduced magnitude.