Specification for the Optical Monitor Operation Catalogue

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1 Scope

The Optical Monitor Operation Catalogue (OMOC) is supposed to be produced by the OAD Star Catalogue Facility (SCF). The compilation specification for the OMOC and the final catalogue content is described in this note.

2 Usage of the catalogue

The OMOC is used for two purposes.

- For each observation field the absence of bright stars, which may damage the detector, is evaluated. The OMOC aims for completeness in this brightness range.
- From the OMOC a list of guide stars is extracted, which is uplinked to the instrument at the begin of an observation, to determine the exact instrument attitude. Completeness is not required for that purpose.

There is an overlap in brightness of stars used for the two applications. While a 14th mag A0 star can be used as guide star in the field acquisition (V-filter), the 14th mag star precludes an exposure in the white light filter, as it is acts as a bright source exceeding the a count rate of 500 cts/sec. Because of that overlap the OMOC should aim for completness down to the specified limiting magnitude.

3 OMOC Specification

3.1 Input Catalogues to Merging Process

The OMOC is produced by merging the following source catalogues

- the Tycho/Hipparcos,
- the GSCV1.1 or GSCV1.2,
- the USNO-A1 catalogue.

The Tycho/Hipparcos catalogue provide the most accurate all-sky data. Either GSCV1.1 or GSCV1.2 are required because they - in opposite to GSCV1.0 - were complemented by entries from the Tycho input catalogue towards the bright end. Although less accurate in its photometric calibration the USNO-A1 catalogue will guarantee the completeness of the OMOC down to the required limiting magnitude.

The OMOC contains no Solar System Objects, as tracing of SSOs will be done by the angular separation tool at scheduling time of the observations.

3.2 Double Entries

OMOC shall be as complete as possible, therefore an entry should be included into the OMOC in case of doubt. Any entry of the source catalogues passing the selection criteria shall be included into the OMOC, except the entry is identified as duplication of an entry of another source catalogue entry. An entry identfied as duplication shall not be included. In the final catalogue there is only one entry for each group of entries meeting the double entry criteria. The attributes of the final OMOC entries are extracted from the catalogue with the highest accuracy (cf. section 3.2.2).

3.2.1 Double Entry Criterium

Entries of different catalogues are considered to be identical if they have a spatial coincidence of ≤ 1.5 arcsec and their brightness agrees within 1 mag.

For objects with large proper motion the position have to be compared at the epoch of the USNO-A1 exposures. A calculation of the position at the epoch of the USNO-A1 plates is only possible for those entry where the proper motion is known. If no proper motion information is available, the proper motion is assumed to be zero.

Identification of duplicated entries is also possible using cross reference fields in the source catalogues (e.g. the "zoneXXXX.lut" files of the USNO catalogue).

3.2.2 Double Entry Handling

During the merging process the catalogues are treated with a different priority reflecting the accuracies of the source catalogues. Entries originating from the Tycho/Hipparcos catalogue have preference over GSCV1.2 and USNO-A entries. GSCV1.2 entries superseed the USNO-A entries.

3.2.3 Large Proper Motion Objects

As far as there is a proper motion value listed in the original catalogue, the value shall be contained in the OMOC.

Once the master catalogue is compiled a run catalogue shall be extracted with all celestial objects (no solar system objects) exceeding a proper motion of 1 arcsec.

3.3 Photometry

Magnitudes are given in the UBV Johnson system. If required the magnitudes are transformed into UBV Johnson system using an appropriate colour transformations. In absence of an appropriate colour transformation a spectral class A0 shall be assumed and the conversion coefficients shall be taken from spectral class-colour index tables (cf. Zombeck).

3.4 Completeness Limit of OMOC

The required brightness limit for bright sources is driven by the throughput of the white light filter. The bright source limit of an white light exposure is V=15 mag. Therefore the OMOC shall be complete down to V=15 mag. The photometric uncertainty is estimated to be as bad as 1.5 mag in some cases. Considering the estimated photometric accuracy objects listed as 16.5 mag or brighter shall be included into the OMOC.

Note that this limit already covers the dynamic range required for the OM field acquisition, which takes place in the V-filter.

3.5 OMOC Format

There are no requirements on the catalogue format as it is assumed that format is internal to the SCF. The required read routines are provided together with the catalogue.

3.6 List of OMOC Fields

The catalogue fields are listed in table 1. Mandatory fields are bold face letters, i.e. these are the minimum fields that will have a meaningful value. All the other fields may be filled by blanks or be populated with a default value. In case of the brightness there must be one entry at least, which can be either V or B magnitude. Empty fields shall be filled with an unkown code, which is listed in table 1.

The spectral type is not listed in the OMOC, as this information is of limited use only. The spectral class is only known for rather bright stars, which can't be observed by OM anyhow. For fainter sources, where the spectral class could be helpful to relax the bright source constraint, the spectral classification is general not available. For that reason it is decided not to include the spectral classification into the catalogue.

description	required accuracy	unkown code
position α	0.1 arcsec	-
position δ	0.1 arcsec	-
magnitude type		-
magnitude	0.5 mag	-
magnitude accuracy	0.5 mag	9.9
variability flag		-
proper motion μ_α	0.1 arcsec	0
proper motion μ_δ	0.1 arcsec	0
source catalogue		-
reference number in source catalogue		-
internal reference number		-
colour B-V	0.1 mag	99.9
colour accuracy $\Delta B - V$	0.1 mag	9.9
area of extended object	1 arcsec^2	0.0

Table 1: Fields in the OMOC, their required accuracy and the code used for unkown entries.

3.7 Description of OMOC Fields

3.7.1 Position

The position is listed in the J2000. In case of the UNSO entries a zero proper motion is assumed to convert the positions into the J2000 system.

However during the OMOC compilation process a crossmatch has to be made between the USNO and the Hipparcos/Tycho catalogue at the epoch of the USNO, in order to eliminate duplicated entries.

3.7.2 Brightness

The brightnesses are listed in the UBV Johnsen system. The brightnesses of the stars listed are the V-magnitude if available. If the V-brightness is not available preferably the B-magnitude is listed instead.

Different colour transformations are needed for the transformation from the source catalogue photometric system into the UBV Johnsen system. For fainter sources, where only a USNO entry exists and the USNO catalogue lists only the R-magnitude, the transformation into V-magnitudes should be made assuming an A0 star, i.e. V-R=+0.02.

The brightness uncertainty is composed out of the average accuracy of the catalogue, the average accuracy of the colour transformation and the quality associated with each entry.

3.7.3 Variability Flag

The variability flag shall be used to indicate variability in the source brightness. The flag should be used as indicated below.

variability flag value	description
blank	no suspected variability
1	suspected variable with amplitude smaller than 2 magnitudes
2	suspected variable with amplitude larger than 2 magnitudes
3	known variable with amplitude smaller than 2 magnitudes
4	known variable with amplitude larger than 2 magnitudes

In case of absence of information the variability flag will be left blank.

3.7.4 Proper Motion

The proper motion will only be available for entries originating from the Hipparcos/Tycho catalogue. In absence of information a proper motion of 0.0 arcsec/year is assumed.

3.7.5 Entry Origin and Entry Reference

It shall be possible to uniquely identify a catalogue entry within OMOC. This is achieved with a reference number. The celestial cube ID may be used in the referencing.

In addition it shall be possible to identify the origin of a selected entry. This requires a flag indicating the source catalogue and the entry ID in the source catalogue.

3.7.6 Colour Information

The B-V colour of the object is listed in the field. If the colour index is not available the field is set to 99.9.

There are different contributors to the uncertainty of the colour index. The average uncertainty of the B and V magnitudes contribute as well as any uncertainties in performed transformation to obtain these magnitudes.

3.7.7 Extended Object Flag

If an object is extended its approximated size in units of square acrsec is indicated in this field. For point sources the source extend parameter is set to zero.