TIC v5 and CTL v5.xx Data Release Notes

> ⊘ This is an older version of the TESS Input Catalog. It is only available for bulk downloads. The TIC Version 8.2 is the current version, please consult that documentation.

TESS Input Catalog Version 5 (TIC-5) Release Notes 2017-07-11

This delivery contains the fifth version of the TESS Input Catalog (TIC) produced entirely by the Target Selection Working Group (TSWG), and was delivered to the TESS Science Office (TSO) on 2017 May 15.

The delivery has a number of minor issues (see below) which have not been fixed in this version due to time constraints during preparation. Specific details of the method of production and the contents of this TIC are described in detail in the full TIC Documentation on the arXiv at (https://arxiv.org/abs/1706.00495) and are not repeated here.

The format used is the same as TIC-4, in that the specific columns and their format are the same, but there have been significant changes compared to TIC deliveries prior to TIC-5. TIC IDs have not been changed and all future deliveries of the TIC will use the same IDs for specific objects, and new objects added will receive new IDs.

Changes compared to TIC-4

This delivery contains major changes in computed quantities compared to TIC-4. It should be noted the methods used to estimate a variety of the stellar parameters are still under active development and can be affected by poor catalog photometry when there is no acceptable alternative photometry for a given star. The major changes compared to previous versions are:

1. An internal database error in the reduced proper motion selection in TIC-4 was corrected. Originally, this error resulted in ~11 million likely dwarfs being excluded from the TIC-4 CTL and ~600K stars which are likely giants being included in the CTL. The contaminants have been removed and the possible dwarfs included in the new CTL selection (see 5 & 6 below).
2. We now define a 0.05 mag area to the left of V-Ks = 2.2241 above the polynomial fit to the data from Bessell & Brett, 1988 (see Figure 10 in the documentation). Stars within this area are assumed to have 0 reddening and have been flagged as 'dered0'.
3. We now select a maximum E(B-V) value of 1.5 rather than 15.
4. The priority calculation has been updated to properly combine TESS's expected photometric precision and the expected contamination ratio for a given source. The contamination ratio and photometric error are now combined as sqrt(+1)*(*10^-6), where is the contamination ratio and is the expected photometric precision in ppm.
5. In addition to requiring CTL stars to be RPMj dwarfs and have T < 15 (unless in a special target list), the CTL now excludes stars where T > 12 and Teff > 5500 K.
6. Any star with J-H > 0.75 is now excluded from the CTL (even if it is identified as a reduced proper motion dwarf) unless it is included in the cool dwarf list or has a spectroscopic Teff.
7. We have implemented a variety of internal consistency checks to ensure parameters such as mass, radius, log(g) etc are all internally consistent within the reported values for any given star in the TIC. See Appendix D of the documentation for more details.
8. Stars within 15 deg of the Galactic Plane (|b| < 15) have their priorities de-boosted by a factor of 0.1.
9. Minor fixes and exclusions of stars left in the CTL from legacy versions of the cool dwarf list.
10. The contamination ratio no longer uses galaxies as possible contaminants. The galaxy distribution is expected to be homogenous across the sky and eliminating the galactic contamination relieves much of the structure present in the distribution of top priority CTL targets.
11. The CTL now incorporates a "Bright Star" specially curated target list. This includes all stars in the TIC with T<6. Contamination ratios were calculated for this target list and priority values were set to be 1. These stars, in most cases, do not have all stellar parameters, such as mass and radii, calculated.

Notes on the individual columns

No.	Name	Notes
2	Version	This column denotes the date YYYYMMDD, in which the TIC was delivered to the POC. A typo left the date as 20160515, it should be 20170515.
7	SDSS	The values given are the 64-bit "objID" values, not the IAU-format "SDSSJ" identifiers.
9	GAIA	In TIC-5 we only include Gaia object IDs for the Gaia-TGAS subsample.
10	APASS	APASS stars do not have an identifier, only coordinates. We use the primary key of an internal TESS version of the APASS database table as a proxy identifier.
17	pmRA	The RA proper motions, in order of preference, are (1) Gaia-TGAS, (2) Superblink, (3) Tycho-2, (4) Hipparcos, and (5) UCAC4. If a star did not have a proper motion in these catalogs, it is not provided.
19	pmDec	The Dec proper motions, in order of preference, are (1) Gaia-TGAS, (2) Superblink, (3) Tycho-2, (4) Hipparcos, and (5) UCAC4. If a star did not have a proper motion in these catalogs it is not provided.

22   plx   The parallax values, in order of preference are (1) Gaia-TGAS, and (2) Hipparcos. Some values are negative because of the way the parallaxes were measured in TGAS and Hipparcos.

29   Bmag   Johnson B magnitude. When a Johnson B magnitude was not found in one of the optical catalogs, the TIC reports a Johnson B derived from the USNO-A2.0 magnitude given in the 2MASS catalog.

59   Gmag   Gaia magnitudes are included in TIC-5 only for the TGAS subsample.

61   Tmag   This column is never NULL. The Tmag values are typically based on relations that depend on J and V-Ks or J-Ks (see column 63 for method flag). TESS magnitudes for objects for which only poor catalog photometry was available were computed simply as offsets from a reference magnitude (see Documentation Section 2.2.2).

63   TESSflag   See TIC-5 Documentation Section 2.2.1 for details of each method. While most of these relations (which are used for most Tmag values) are only appropriate for dwarf stars, some are applicable to giants. Extended objects were treated as if they were dwarfs. In general the dwarf relations are strictly valid between specific color ranges and tend to be less accurate for very blue stars (J-Ks < -0.1) or very red stars (J-Ks > 1). These flags denote which relation or catalog provides the TIC TESS magnitude:

        hipvmag: T calculated from Cool Dwarf list (see Documentation Section E.1.1 and Muirhead et al. (2017 in prep)

        cdwarf: T calculated from Cool Dwarf list (see Documentation Section E.1.1 and Muirhead et al. (2017 in prep)

        from_apass_i: T calculated from cdwarf catalog (see Sec. E.1.1 & Muirhead et al. 2017)

        from_sdss_i: T calculated from cdwarf catalog (see Sec. E.1.1 & Muirhead et al. 2017)

        wmean_vk_jhk: T calculated from cdwarf catalog (see Sec. E.1.1 & Muirhead et al. 2017)

        hoffset: Tmag calculated from 2MASS H + offset.

        joffset: Tmag calculated from 2MASS J + offset.

        koffset: Tmag calculated from 2MASS Ks + offset.

        lepine: Tmag calculated using the V magnitude from the Lepine catalog

        bpjk: Relation using 2MASS JKs and photographic B.

        jhk: Relation using 2MASS JHKs.

        vjk: Relation using 2MASS JKs and Johnson V.

        voffset: Tmag calculated from V + offset.

        tmvk: Relation using 2MASS calculated V and Ks.

        jh: Relation using 2MASS JH.

        sdss: Relation for extended objects using Sloan g and i.64 SPFlag These flags denote the origin of stellar characteristics:

        cdwarf: mass and radius provided by the Cool Dwarf list

        plx: characteristics computed from measured parallax

        spect:characteristics computed using the spectroscopic Torres relations

        allen: characteristics computed from spline relations based on eclipsing binary properties and TRILEGAL simulations

        normal: same as allen, naming artifact to be removed in future releases

65   Teff   The effective temperatures come from one of four sources, in the following order of preference: (1) the Cool Dwarf list; (2) spectroscopic catalogs (see Column 64); (3) dereddended V-Ks color; and (4) non-dereddened V-Ks color. Please note that all stars with Teff < 3840 K have been excluded from any de-reddening, on the assumption that they are nearby M dwarfs.

66   e_Teff   The SPOCS and GALAH catalogs do not provide uncertainties for effective temperatures; 25K and 41K were assigned, respectively, based on the reported statistical error from those catalogs.

67   Logg   The surface gravities reported in column 67 of TIC-5,do not accurately represent the expected surface gravities using the reported values for mass (column 73) and radii (column 71). This only affects stars where the stellar properties were calculated using available parallax information (the stellar properties flag is set to 'plx' in column 64) and no other quantities in the TIC are affected. TIC users can either calculate the surface gravity using the provided mass and radius values or use the linked data file (http://astro.phy.vanderbilt.edu/~oelkerrj/ftp/tic5_logg_fix.csv) to access the appropriately calculated values. This fix will be built into the next version of the TIC, version 6.

68   e_Logg   The SPOCS and GALAH catalogs do not provide uncertainties for surface gravities; 0.028 and 0.17 dex were assigned, respectively, based on the reported statistical error from those catalogs.

70   e_M/H   The SPOCS and GALAH catalogs do not provide uncertainties for metallicities; 0.10 and 0.05 dex were assigned, respectively, based on the reported statistical error from that catalog.

71   Mass   If an object's mass is provided in the specialized Cool Dwarf list it is included in the TIC. Otherwise, the stellar masses were estimated using a relation based on measured masses for eclipsing binaries as well as simulations using Galactic structure models.

73   Radius   The stellar radii were estimated using a variety of techniques, in the following order of preference: (1) the Cool Dwarf list; (2) spectroscopic relations from Torres et al. 2010, A&ARv, 18, 67; (3) using the Gaia parallax and bolometric corrections; and (4) a unified relation based on measured radii for eclipsing binaries as well as simulations using Galactic structure models.

77   LumClass   This is a boolean dwarf flag. If this is set, LumClass = DWARF, or otherwise GIANT. SUBGIANT is not used at present. However, the DWARF flag for TIC-5 effectively means that the star is either a dwarf or a subgiant, based on reduced proper motion cuts.

82   E(B-V)   Stars for which E(B-V) > 1.5 have their E(B-V) values set to a maximum of 1.5.

85   contratio   The contamination ratio is defined as the nominal flux from the contaminants divided by the flux from the source. Flux contamination is calculated for all stars identified as dwarfs that are brighter than Tmag=15, or are in special target catalogs such as the Cool Dwarf list. Contaminants are searched for within 10 TESS pixels of the target and the contaminating flux is calculated within a radius that depends on the target's Tmag. The PSF is modeled using a 2D-Gaussian based on preliminary PSF measurements from the SPOC.

88   priority   Priority of target for observation. This is a floating-point value ranging from 0 to 1, where 1 is highest priority. The priority is based on the relative ability of TESS to detect small planetary transits, and is calculated using the radius of the star, the contamination ratio, and the total expected photometric precision. Stars within the continuous viewing zones (|b| > ~78 deg) are given a boost to their priority by a factor of sqrt(13), as they will be observed roughly 13 times longer than the majority of TESS targets. Stars within the Galactic Plane (|b|<15) have been de-boosted by a factor of 0.1 since we generally have a poor understanding of their true de-reddening.

The following columns are not populated:

No. Name

83 e_EBV

86 Disposition

Known Issues and Pitfalls:

There are a number of minor issues which have been identified by the TSWG. We expect to address these issues in a future version of the TIC. The issues include:

1. All coordinates are for the epoch of observation (often 2MASS or SDSS). Epochs are not currently supplied.
2. Because some stars have poor quality 2MASS photometry flags (such as 'D', 'U'), offsets where applied to V, J, H, or Ks magnitudes to provide a more realistic TESS magnitude but may be different from the true value by a magnitude or more.
3. There is a clear pattern in the sky distribution of top CTL stars. This is a combination of three effects: The first is from the SuperBlink/UCAC4 /Proper Motion Catalogs. The edge at ~-30 deg is due to the incompleteness in these catalogs. The second effect is the priority boost to stars in the CVZ, typically any star with an ecliptic latitude greater than 78 is more likely to have a high priority. The third effect is the priority de-boost to stars within 15 degrees of the Galactic Plane by a factor of 0.1.
4. A typo left the Version date as 20160515, it should be 20170515.
5. The surface gravities reported in column 67 of TIC-5,do not accurately represent the expected surface gravities using the reported values for mass (column 73) and radii (column 71). This only affects stars where the stellar properties were calculated using available parallax information (the stellar properties flag is set to 'plx' in column 64) and no other quantities in the TIC are affected. TIC users can either calculate the surface gravity using the provided mass and radius values or use the linked data file (http://astro.phy.vanderbilt.edu/~oelkerrj/ftp/tic5_logg_fix.csv) to access the appropriately calculated values. This fix will be built into the next version of the TIC, version 6.
6. For TIC-5, numerical columns with values of exactly 0 are actually null values. Starting in TIC-6, these will be properly set to null, but due to a translation error they have been assigned values of exactly 0 in TIC-5 at MAST.

Planned Improvements in Future Versions:

There are a number of planned improvements for the future versions of the TIC. At present these improvements include:

1. A refinement of the algorithm for calculating the expected photometric error based on Tmag to include properties such as the coordinates, to properly account for zodiacal light.
2. All coordinates to be prepared in equinox J2000.0, and epoch 2000.0.
3. Create a more extensive list of stars with known radii and masses, so that we can test expanded mass and radius relations.
4. Fully incorporate Gaia magnitudes into the calculation of Tmag, positions, and source IDs.
5. Improve dwarf/sub-giant/giant classification using Gaia parallax information.