

ODTK GPS ISC File Description

1 Introduction – Inter-Signal Group Delay Differential Correction

References IS-GPS-200 paragraph 30.3.3.3.1.1.1,
 IS-GPS-705E paragraph 20.3.3.3.1.1.1,
 IS-GPS-800B paragraph 3.5.3.9:

Due to variations in the delays across various signal paths, the different GPS signals emerge from the SV antennas at different times. To account for this, the SV time offset for a given signal type (“X”) is corrected from the “nominal” SV time offset by an equation of the form:

$$\Delta t_{SVX} = \Delta t_{SV} - T_{GD} + ISC_X$$

Where X is the signal type, e.g. L1C/A, L2C, L5I, L5Q, L1Cp, L1Cd

T_{GD} is a group delay correction term applicable to a given SV (see IS-GPS-200 paragraph 20.3.3.3.2)

ISC is the inter-signal delay.

These group delay parameters are initially calibrated by the SV manufacturer on the ground, and may be up updated to reflect actual on-orbit values. The T_{GD} and ISC values for L1C/A, L2C, L5I, L5Q are broadcast in the NAV message type 30. ISC values for L1Cp, and L1Cd are in the NAV message subframe 2. The T_{GD} value is also available in the RINEX NAV message (see the discussion in the GNSS Catalog file maintenance document in your ODTK install). With advances in the GPS constellation design that now require the use of ISC values these are now being broadcast in more advanced versions of the NAV message called CNAV and CNAV-2 (with the legacy NAV message now being referred to as LNAV). The normal RINEX 3.0 files logged by the IGS are named *_GN.rnx (for GPS) and *_EN.rnx (for Galileo) and contain the LNAV data only. To capture the CNAV data the IGS introduced a new file *_M.rnx in a not official “RINEX 4.0” format. The file format can be found at <https://cddis.nasa.gov/archive/gnss/data/campaign/cnav/2013/06/aaaReadme.txt>. The *_M.rnx files can be found at <https://cddis.nasa.gov/archive/gps/data/daily/2021/brdc/> or <ftp://igs.ign.fr/pub/igs/data/2021/038/>. The M files contain CNAV information for both GPS and QZSS.

This file contains ISC values used to initialize the Constellation ISCDelayTable (note that the T_{GD} is input from the Catalog file). The CNAV data contains ISC values for L1 C/A, L2C, L5I5, and L5Q5. The other data columns L1Cp, L1Cd, L1M, and L2M in the ISC file are not in the NAV message and value must be obtained from documents published by the satellite manufacturer. The GPS III satellites are the only ones with these values (see <https://www.navcen.uscg.gov/?pageName=gpsTechnicalReferences>).

2 File Description

Reference the example file given in section 3.

The file consists of:

1. Version Record as first record in the file.
2. Comment Cards (optional).
3. A Data record for each SV that is white space delimited. The ordering of the delays must match the ordering shown in the example. Note that there is a column for TGD; this column is read in but not currently used, TGD is currently input via the catalog file.

3 Example GNSS Catalog Files

ODTK.V.6.4.0;

// Inter-Signal Correction (ISC) Group Delays in seconds

// Civilian signals from Message 30, Military signal from military message (TBD)

// Reference IS-GPS-705B, Table 20-IV and IS-GPS-800B, Table 3.5-1 subframe 2

// SVN	Tgd	L1CA	L1Cp	L1Cd	L2C	L5I5	
L5Q5	L1M	L2M					
48	-1.0710209608080E-08	-8.4401108324530E-10	0.000000000000E+00	0.000000000000E+00	6.5192580223080E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					
50	-1.0244548320770E-08	-3.2014213502410E-10	0.000000000000E+00	0.000000000000E+00	5.4133124649520E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					
52	-1.3038516044620E-08	-5.5297277867790E-10	0.000000000000E+00	0.000000000000E+00	7.3632691055540E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					
53	-1.0244548320770E-08	-8.4401108324530E-10	0.000000000000E+00	0.000000000000E+00	6.1700120568280E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					
55	-1.0244548320770E-08	-4.6566128730770E-10	0.000000000000E+00	0.000000000000E+00	5.6170392781500E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					
57	-9.3132257461550E-09	-7.5669959187510E-10	0.000000000000E+00	0.000000000000E+00	5.0640664994720E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					
58	-1.2107193470000E-08	-7.5669959187510E-10	0.000000000000E+00	0.000000000000E+00	6.6356733441350E-09	-1.1920928955080E-07	-
1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00					

62	5.5879354476930E-09	-2.0663719624280E-09	0.000000000000E+00	0.000000000000E+00	-5.2386894822120E-09	-3.7834979593750E-10	-
	8.7311491370200E-10	0.000000000000E+00	0.000000000000E+00				
63	8.3819031715390E-09	-2.2992026060820E-09	0.000000000000E+00	0.000000000000E+00	-7.5669959187510E-09	3.7834979593750E-10	
	2.1536834537980E-09	0.000000000000E+00	0.000000000000E+00				
64	5.1222741603900E-09	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00	
	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00				
65	3.2596290111500E-09	-2.6193447411060E-10	0.000000000000E+00	0.000000000000E+00	-2.2700987756250E-09	2.2700987756250E-09	
	3.6961864680050E-09	0.000000000000E+00	0.000000000000E+00				
66	3.7252902984620E-09	-1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00	-1.1920928955080E-07	-1.1920928955080E-07	-
	1.1920928955080E-07	0.000000000000E+00	0.000000000000E+00				
67	-6.0535967350000E-09	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00	
	0.000000000000E+00	0.000000000000E+00	0.000000000000E+00				