

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 29 (1990 July 2)

1 - COORDINATED UNIVERSAL TIME UTC. Computed values of UTC-UTC(k)

(Since 1990 January 1, 0h UTC, TAI-UTC = 25s)

Date 1990 (0h UTC)	APR 28	MAY 8	MAY 18	MAY 28
MJD	48009	48019	48029	48039
Laboratory k	UTC-UTC(k)	(Unit = 1 microsecond)		
AOS (Borowiec)	-2.67	-3.34	-3.95	-4.60
APL (Laurel) (1)	1.30	0.46	0.47	0.49
ASMW (Berlin)	0.28	0.26	0.04	-0.15
AUS (Canberra)	-1.01	-0.94	-0.86	-0.79
BEV (Wien)	7.10	6.43	6.17	5.74
CAO (Cagliari)	8.54	8.29	8.80	8.60
CH (Berne)	-0.45	-0.37	-0.29	-0.21
CRL (Tokyo)	-0.32	-0.25	-0.18	-0.11
CSAO (Shaanxi)	-6.40	-6.65	-6.69	-6.89
DPT (Pretoria)	-20.83	-20.98	-21.07	-21.18
FTZ (Darmstadt)	16.46	16.44	16.38	16.42
IEN (Torino)	-0.91	-0.91	-0.91	-0.93
IFAG (Wetzell)	-1.20	-1.10	-1.09	-0.98
INPL (Jerusalem)	169.55	171.64	173.73	175.75
JATC (Xian)	-15.47	-16.07	-16.56	-17.24
KSRI (Taejon)	-59.05	-59.89	-60.64	-61.39
NAOM (Mizusawa)	-3.76	-3.97	-4.10	-4.24
NIM (Beijing)	8.98	8.87	8.89	9.18
NIST (Boulder)	0.51	0.50	0.49	0.46
NPL (Teddington)	-2.34	-2.36	-2.41	-2.49
NPLI (New-Delhi)	-26.04	-	-28.81	-29.25
NRC (Ottawa)	0.15	0.35	0.64	0.83
NRLM (Tsukuba)	-28.80	-28.22	-27.69	-27.19
OMH (Budapest)	1.62	1.28	1.33	1.46
ONRJ (Rio de Janeiro)	11.70	11.65	11.80	12.00
OP (Paris)	-0.65	-0.66	-0.65	-0.59
ORB (Bruxelles)	6.37	6.56	6.74	6.97
PEL (Lower Hutt)	-	-	-	-
PKNM (Warsaw)	-6.85	-7.32	-6.98	-6.59
PTB (Braunschweig)	3.70	3.69	3.70	3.71
RC (Havana)	-3.11	-3.41	-3.53	-3.63
ROA (San Fernando)	9.05	8.92	8.88	8.85
SO (Shanghai)	3.77	3.72	3.61	3.68
STA (Stockholm)	-0.02	-0.06	-0.11	-0.55
SU (Moscow)	-	-	-	-
TAO (Tokyo)	-4.01	-3.83	-3.63	-3.41
TL (Taiwan)	2.36	2.51	2.69	2.88
TP (Praha)	0.73	-0.04	-0.24	0.25
TUG (Graz)	-1.60	-1.32	-1.09	-0.85
USNO (Washington) (USNO MC)	-1.01	-0.94	-0.86	-0.79
VSL (Delft)	2.72	2.75	2.74	2.76
YUZN (Beograd)	16.19	15.80	15.96	16.41
ZIPE (Potsdam)	0.03	0.04	-0.01	-0.13

2 - INTERNATIONAL ATOMIC TIME TAI AND LOCAL ATOMIC TIME SCALES TA(k)

Computed values of TAI-TA(k)

Date 1990 (0h UTC)	APR 28	MAY 8	MAY 18	MAY 28
MJD	48009	48019	48029	48039
Laboratory k	TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)	-2.67	-3.34	-3.95	-4.60
APL (Laurel)	-0.04	-0.05	-0.04	-0.02
AUS (Canberra)	-27.35	-27.52	-27.78	-28.02
CH (Berne)	-64.72	-64.91	-65.10	-65.28
CRL (Tokyo)	-1.43	-1.35	-1.26	-1.18
CSAO (Shaanxi)	30.81	30.45	30.32	30.01
DDR (Berlin)	-26.02	-25.91	-25.90	-26.02
F (Paris)	80.24	80.54	80.83	81.12
JATC (Xian)	-1.32	-1.33	-1.29	-1.27
NIM (Beijing)	-11.07	-11.12	-11.06	-10.72
NISA (Boulder) (2)	-45064.02	-45064.23	-45064.44	-45064.67
NIST (Boulder)	-45141.57	-45142.13	-45142.69	-45143.27
NRC (Ottawa)	16.21	16.42	16.71	16.90
PTB (Braunschweig)	-359.70	-359.71	-359.70	-359.69
RC (Havana) (3)(4)	-263.00	-263.38	-263.61	-264.05
SO (Shanghai)	-43.73	-43.76	-43.88	-43.80
SU (Moscow)	-	-	-	-
USNO (Washington) (5)	-34600.07	-34600.72	-34601.37	-34602.02

3 - NOTES ON SECTIONS 1 AND 2

(1) APL . Time step of UTC(APL) of +0.831 μ s on MJD = 48011 .

(2) TA(NISA) designates the scale AT1 of NIST.

(3) Erratum . MJD TAI-TA(RC)

47989	-262.63
47999	-262.84

(4) RC . Listed values are TAI-TA(RC) - 18 seconds.

(5) TA(USNO) designates the scale A1(MEAN) of USNO.

4 - UTC-GPS TIME and TAI-GPS TIME

UTC-GPS TIME = -6 seconds + Co ; TAI-GPS TIME = 19 seconds + Co.

Co is obtained from measurements made at Paris Observatory, usually corrected for the measured ionospheric delay, and from linear interpolation of UTC-UTC(OP).

DC is the synchronization offset between satellites, as measured at Paris Observatory at the instant T of the tracking. T is given for the middle of the tracking period of 13 minutes, for the first tabular date and must be decremented by 4 minutes per day (8 minutes when moving from 0h.. to 23h..).

For most of the applications it is sufficient to derive UTC from the observations of any of the listed satellites, at any time, by interpolating Co. However, in case of large values of DC, one might obtain better values of UTC by using, instead of Co, $C=Co+DC$.

Date 1990	MJD	Co (ns) 0hUTC	DC(ns)						
			PRN11 NAV 8 3h 8m	PRN14 NAV14 6h20m	PRN 6 NAV 3 10h36m	PRN 9 NAV 6 13h32m	PRN12 NAV10 14h20m	PRN13 NAV 9 15h20m	PRN 3 NAV11 16h40m
APR 28	48009	-1120	-	-	2	0	-9	-18	4
APR 29	48010	-1111	5	-	5	24	2	-16	2
APR 30	48011	-1107	1	-	1	1	7	23	2
MAY 1	48012	-1107	-11	-	3	-6	4	-12	8
MAY 2	48013	-1099	0	-	-4	2	14	-12	7
MAY 3	48014	-1091	-	-	4	9	4	-10	-3
MAY 4	48015	-1087	-11	-	5	18	-18	-8	4
MAY 5	48016	-1082	-12	-	16	18	20	-12	3
MAY 6	48017	-1077	-16	-	2	6	6	-14	6
MAY 7	48018	-1073	-4	-	12	10	8	4	-5
MAY 8	48019	-1074	-12	-	2	12	-3	-12	0
MAY 9	48020	-1072	-4	-	-1	6	33	-17	1
MAY 10	48021	-1065	9	-	9	8	-24	-15	8
MAY 11	48022	-1054	5	-	4	7	3	0	3
MAY 12	48023	-1045	-2	-	3	14	-13	-22	1
MAY 13	48024	-1034	5	-	3	17	-6	-19	-1
MAY 14	48025	-1020	9	-	3	13	-22	-3	5
MAY 15	48026	-1006	3	-	-2	10	3	-10	-11
MAY 16	48027	-996	5	-	14	6	-11	-17	5
MAY 17	48028	-987	2	-	3	1	-15	-15	4
MAY 18	48029	-977	4	-	-4	7	-2	1	-2
MAY 19	48030	-961	-	-	8	2	-17	-11	10
MAY 20	48031	-948	-5	-	3	7	8	-8	1
MAY 21	48032	-935	-5	-	4	10	-2	-15	-2
MAY 22	48033	-920	7	-	18	30	-21	-14	2
MAY 23	48034	-908	14	-	1	2	-12	-6	-4
MAY 24	48035	-898	-	-	5	1	2	-9	7
MAY 25	48036	-890	-	-	-1	26	-19	-8	6
MAY 26	48037	-880	-	-	-2	7	-3	-16	-2
MAY 27	48038	-864	-	-	5	21	-7	-	-
MAY 28	48039	-845	-	-	1	8	0	-41	-3

5 - UTC-GLONASS TIME

Measurements are currently in progress at the University of Leeds by Prof. P. Daly to establish system time references of both GPS and GLONASS. In the table below, C1 = UTC-GLONASS time is derived from these measurements after interpolation at 0 h UTC and from UTC-GPS time of section 4. The standard deviation is SD. These data are obtained with a single receiver and therefore, unconfirmed. They are averaged on about 10 satellites.

Date 1990	MJD	C1 (μ s) 0 h UTC	SD (μ s)
APR 28	48009	46.94	0.11
MAY 8	48019	47.12	0.07
MAY 18	48029	47.31	0.09
MAY 28	48039	47.55	0.06

6 - DURATION OF THE TAI SCALE INTERVAL : 1 second + D

D and its standard deviation s are expressed in $1 \cdot 10^{-14}$ second.

The following data are given :

- for continuously operating primary standards (primary clocks), the average of D for the two previous months, with the last available estimate of the inaccuracy of the standard;
- for occasional measurements, the value D for the measurement interval, as computed by BIPM (the BIPM uncertainty may be larger than the reported uncertainty on account of the time comparisons);
- the BIPM evaluation from all available measurements (from CRL, NIST, NRC, PTB, SU), with the uncertainty based on those of individual measurements, as reported.

Standards,	Interval(MJD)	D	s
NRC-CsV	47979-48039	-21.3	10.0
PTB-CS1	47979-48039	+0.6	3.0
PTB-CS2	47979-48039	+4.6	1.5
BIPM estimate	47979-48039	+3	2