

# BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

## Circular T 22 (1989 December 1)

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

(From 1988 January 1, 0h UTC, to 1990 January 1, 0h UTC, TAI-UTC = 24s)  
 (From 1990 January 1, 0h UTC, until further notice, TAI-UTC = 25s)

Date 1989 (0h UTC)	SEP 30	OCT 10	OCT 20	OCT 30
MJD	47799	47809	47819	47829
Laboratory k	UTC-UTC(k)	(Unit = 1 microsecond)		
	(1)			
AOS (Borowiec)	-11.37	-10.77	-10.16	-9.43
APL (Laurel)	(2) -	-0.22	-0.17	-0.12
ASMW (Berlin)	0.16	0.08	-0.04	-0.14
AUS (Canberra)	-0.94	-0.88	-0.83	-0.79
BEV (Wien)	-7.32	-8.13	-	-
CAO (Cagliari)	10.14	10.14	10.10	10.10
CH (Berne)	-0.54	-0.59	-0.67	-0.74
CRL (Tokyo)	-1.01	-0.96	-0.95	-0.93
CSAO (Shaanxi)	-1.37	-1.40	-1.56	-1.85
DPT (Pretoria)	-15.25	-15.42	-15.63	-15.89
FTZ (Darmstadt)	16.71	16.60	16.55	16.54
IEN (Torino)	0.27	0.23	0.17	0.12
IFAG (Wettzell)	-1.19	-0.92	-0.66	-0.31
INPL (Jerusalem)	135.12	136.48	137.79	139.13
JATC (Xian)	-6.68	-6.99	-7.34	-7.87
KSRI (Taejon)	-9.31	-9.25	-9.07	-8.99
NAOM (Mizusawa)	-35.08	-35.05	-34.97	-35.02
NIM (Beijing)	10.19	-	-	-
NIST (Boulder)	-0.20	-0.14	-0.10	-0.08
NPL (Teddington)	-1.31	-1.55	-1.67	-1.69
NPLI (New-Delhi)	-14.95	-15.48	-16.14	-16.81
NRC (Ottawa)	-15.20	-15.32	-15.44	-15.59
NRLM (Tsukuba)	(3) -44.80	-45.20	-45.63	-45.04
OMH (Budapest)	-9.56	-9.76	-9.74	-9.89
ONRJ (Rio de Janeiro)	11.72	11.75	11.80	11.63
OP (Paris)	-0.51	-0.34	-0.20	-0.07
ORB (Bruxelles)	2.59	2.84	3.07	3.20
PEL (Lower Hutt)	1.63	-	-	-
PKNM (Warsaw)	1.55	1.00	0.27	-0.06
PTB (Braunschweig)	3.94	3.90	3.87	3.84
ROA (San Fernando)	8.96	9.05	9.17	9.25
SO (Shanghai)	2.87	3.08	3.06	3.20
STA (Stockholm)	-0.06	0.07	0.14	0.21
SU (Moscow)	(4) -	-	-	-
TAO (Tokyo)	-4.22	-4.25	-4.34	-4.41
TL (Taiwan)	2.14	2.08	2.02	1.87
TP (Praha)	-0.57	-0.50	-0.23	0.20
TUG (Graz)	2.47	2.68	2.87	3.05
USNO (Washington) (USNO MC)	-0.94	-0.88	-0.83	-0.79
VSL (Delft)	1.91	1.96	1.98	2.01
YUZM (Beograd)	20.43	20.52	20.47	21.07
ZIPE (Potsdam)	0.03	-0.07	-0.18	-0.29

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

## Computed values of TAI-TA(k)

Date 1989 (0h UTC)	SEP 30	OCT 10	OCT 20	OCT 30
MJD	47799	47809	47819	47829
Laboratory k	TAI-TA(k)	(Unit = 1 microsecond)		
(1)				
APL (Laurel)	-	-1.56	-1.51	-1.46
AUS (Canberra)	-23.57	-23.81	-24.09	-24.33
CH (Berne)	-60.35	-60.57	-60.82	-61.06
CRL (Tokyo)	-2.29	-2.23	-2.22	-2.19
CSAO (Shaanxi)	37.61	37.59	37.42	37.13
DDR (Berlin)	-28.70	-28.74	-28.74	-28.74
F (Paris)	73.81	74.10	74.39	74.69
JATC (Xian)	-1.25	-1.22	-1.38	-1.41
NIM (Beijing)	-9.48	-	-	-
NISA (Boulder) (5)	-45059.67	-45059.88	-45060.11	-45060.35
NIST (Boulder)	-45131.16	-45131.60	-45132.06	-45132.52
NRC (Ottawa)	15.87	15.75	15.63	15.48
PTB (Braunschweig)	-359.46	-359.50	-359.53	-359.56
SO (Shanghai)	-44.46	-44.28	-44.33	-44.25
SU (Moscow) (4)	-	-	-	-
USNO (Washington) (6)	-34586.76	-34587.31	-34587.78	-34588.29

## 3 - NOTES ON SECTIONS 1 AND 2

(1) No GPS time links available between MJD=47798 and MJD=47801.  
 The computations of UTC and TAI have been made with interpolated values.

(2) APL . Change of master clock on MJD = 47795.

(3) NRLM. Change of master clock on MJD = 47822.

(4) SU .	MJD	UTC-UTC(SU)	TAI-TA(SU)
	47709	14.06	2827264.06
	47719	13.93	2827263.93
	47729	13.92	2827263.92
	47739	13.50	2827263.50
	47749	13.28	2827263.28
	47759	13.05	2827263.05

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

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

## 4 - UTC-GPS TIME and TAI-GPS TIME

UTC-GPS TIME = -5 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 1989	MJD	0hUTC	18h 0m	20h24m	Co (ns)		DC(ns)				
					PRN11	PRN14	PRN 6	PRN 9	PRN12	PRN13	PRN 3
					NAV 8	NAV14	NAV 3	NAV 6	NAV10	NAV 9	NAV11
SEP 30	47799	-	-	-	-	-	-	-	-	-	-
OCT 1	47800	-	-	-	-	-	-	-	-	-	-
OCT 2	47801	-	-	-	-	-	-	-	-	-	-
OCT 3	47802	-1206	11	-6	7	-7	1	-6	-8		
OCT 4	47803	-1185	12	-3	-	13	23	1	11		
OCT 5	47804	-1173	20	-9	-6	-11	-4	-7	-16		
OCT 6	47805	-1152	23	-6	6	-2	-	-15	-9		
OCT 7	47806	-1121	12	10	-5	0	-3	15	1		
OCT 8	47807	-1093	9	-	-21	-6	7	-21	-15		
OCT 9	47808	-1066	9	-	-3	-7	23	7	9		
OCT 10	47809	-1037	18	-	2	4	-13	-10	-9		
OCT 11	47810	-1013	15	-	-8	7	26	2	-4		
OCT 12	47811	-992	17	-	8	-10	7	-8	-7		
OCT 13	47812	-968	17	-	-12	-1	1	-3	-5		
OCT 14	47813	-944	-	-	-9	-4	6	-	-		
OCT 15	47814	-918	14	-	9	1	-10	2	-8		
OCT 16	47815	-894	4	-1	-2	9	4	0	-		
OCT 17	47816	-875	8	-	-1	-5	-10	-12	-5		
OCT 18	47817	-848	9	-19	3	9	-3	-9	8		
OCT 19	47818	-817	0	-6	-2	6	1	0	1		
OCT 20	47819	-787	8	-12	5	-21	-4	-1	1		
OCT 21	47820	-763	18	-9	-4	6	-5	-2	-1		
OCT 22	47821	-746	3	-	-2	-	-1	-1	-6		
OCT 23	47822	-732	18	-	1	1	-11	-8	-4		
OCT 24	47823	-718	1	-	3	7	-5	10	1		
OCT 25	47824	-708	-1	-	-11	-6	-3	-3	1		
OCT 26	47825	-700	12	-	-1	12	3	-13	-7		
OCT 27	47826	-692	9	-	-7	-3	8	-1	8		
OCT 28	47827	-688	4	-	0	4	-10	-2	-3		
OCT 29	47828	-687	19	-	-3	3	-4	0	-5		
OCT 30	47829	-686	13	-	0	-4	-10	-1	-5		

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

D and its standard deviation s are expressed in  $1 \times 10^{-14}$  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	47769-47829	+31.8	10.0
PTB-CS1	47769-47829	+3.2	3.0
PTB-CS2	47769-47829	+4.2	1.5
BIPM estimate	47769-47829	+4	2