

Comparison of Time Scales
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The table on the following pages is derived from Appendix B of IEEE 1588-2002 (= IEC 61588:2004) and from a table from the IERS web site that shows the relationship between TAI and UTC. The columns in the table have the following meanings:

- UTC** Coordinated Universal Time, expressed with the day's date both as a DN (day number) and in "YYYY-MM-DD" and the time of day in "hh:mm:ss" format. (For dates before 1972-01-01, this column shows an approximate value of UT1.)
- DN** A count of days since 17 November 1858 on the Greenwich civil time calendar. Similar to MJD, but is based on a civil time scale rather than any astronomical time scale. Day number 0 is 1858-11-17. Used here only for day numbers from 41,317 onward, when (TAI-UTC) is an integer number of seconds.
- TAI** International Atomic Time, also expressed in "YYYY-MM-DD hh:mm:ss" format.
- TAI-UTC** The current offset between the TAI and UTC time scales, in seconds. This has been an integer number of seconds since 1972-01-01 and increments by one at each positive leap second.
- GPS** The GPS time scale, in seconds since the GPS epoch, and also in GPS weeks of 604 800 seconds and the number of seconds since the start of the GPS week.
- NTP** The NTP time scale, a count of seconds since 1900-01-01 00:00:00 UTC. (When a leap second is inserted into the UTC time scale, the NTP time scale repeats that second, thereby "forgetting" the leap second. (The two consecutive seconds with the same NTP second number may be distinguished by the value of the "LS pending" flag. The LS_61 flag indicates that a positive leap second is pending, and the LS_59 flag indicates that a negative leap second is pending. After the leap second, both flags will be zero.)
- PTP** The "Precise Time Protocol" time scale introduced by the IEEE 1588 (IEC 61588) standard. This is a count of seconds since 1970-01-01 00:00:00 UTC, assuming that each UTC second is an SI second. (That assumption is false, because prior to 1972-01-01 the UTC time scale was steered by rate adjustments and small step adjustments — "rubber seconds" and "leap milliseconds.")

The following table, taken from Appendix B of IEEE 1588, contains formulae for converting between the PTP time scales and certain other time scales.

To convert from	To	Use this formula
NTP seconds	PTP seconds	$PTP\ seconds = NTP\ seconds - 2\ 208\ 988\ 800 + (TAI - UTC)$
PTP seconds	NTP seconds	$NTP\ seconds = PTP\ seconds + 2\ 208\ 988\ 800 - (TAI - UTC)$
GPS seconds = $GPS\ weeks \times 604\ 800 +$ $GPS\ secondsInLastWeek$	PTP seconds	$PTP\ seconds = GPS\ seconds + 315\ 964\ 819$
PTP seconds	GPS seconds	$GPS\ seconds = PTP\ seconds - 315\ 964\ 819$

UTC			TAI	TAI-UTC	GPS			NTP		PTP seconds	Comment	
DN	YYYY-MM-DD	hh:mm:ss	YYYY-MM-DD hh:mm:ss		Seconds	Wk #	Sec # in Wk	LS pending ↓				
	1900-01-01	00:00:00						0	0		NTP Epoch	
	1970-01-01	00:00:00						2 208 988 800	0	0	PTP Epoch	
41 317	1972-01-01	00:00:00	1972-01-01 00:00:10	10				2 272 060 800		63 072 010	UTC Epoch	
41 498	1972-06-30	23:59:59	1972-07-01 00:00:09	10				2 287 785 599	1	78 796 809		
		23:59:60		00:00:10	10				2 287 785 600	1	78 796 810	1 st LS
41 499	1972-07-01	00:00:00	00:00:11	11				2 287 785 600	0	78 796 811		
41 682	1972-12-23	23:59:59	1973-01-01 00:00:10	11				2 303 683 199	1	94 694 410		
		23:59:60		00:00:11	11				2 303 683 200	1	94 694 411	2 nd LS
41 683	1973-01-01	00:00:00	00:00:12	12				2 303 683 200	0	94 694 412		
42 047	1973-12-23	23:59:59	1974-01-01 00:00:11	12				2 335 219 199	1	126 230 411		
		23:59:60		00:00:12	12				2 335 219 200	1	126 230 412	3 rd LS
42 048	1974-01-01	00:00:00	00:00:13	13				2 335 219 200	0	126 230 413		
42 412	1974-12-23	23:59:59	1975-01-01 00:00:12	13				2 366 755 199	1	157 766 412		
		23:59:60		00:00:13	13				2 366 755 200	1	157 766 413	4 th LS
42 413	1975-01-01	00:00:00	00:00:14	14				2 366 755 200	0	157 766 414		
42 777	1975-12-23	23:59:59	1976-01-01 00:00:13	14				2 398 291 199	1	189 302 413		
		23:59:60		00:00:14	14				2 398 291 200	1	189 302 414	5 th LS
42 778	1976-01-01	00:00:00	00:00:15	15				2 398 291 200	0	189 302 415		
43 143	1976-12-23	23:59:59	1977-01-01 00:00:14	15				2 429 913 599	1	220 924 814		
		23:59:60		00:00:15	15				2 429 913 600	1	220 924 815	6 th LS
43 144	1977-01-01	00:00:00	00:00:16	16				2 429 913 600	0	220 924 816		
43 508	1977-12-23	23:59:59	1978-01-01 00:00:15	16				2 461 449 599	1	252 460 815		
		23:59:60		00:00:16	16				2 461 449 600	1	252 460 816	7 th LS
43 509	1978-01-01	00:00:00	00:00:17	17				2 461 449 600	0	252 460 817		
43 873	1978-12-23	23:59:59	1979-01-01 00:00:16	17				2 492 985 599	1	283 996 816		
		23:59:60		00:00:17	17				2 492 985 600	1	283 996 817	8 th LS
43 874	1979-01-01	00:00:00	00:00:18	18				2 492 985 600	0	283 996 818		
44 238	1979-12-23	23:59:59	1980-01-01 00:00:17	18				2 524 521 599	1	315 532 817		
		23:59:60		00:00:18	18				2 524 521 600	1	315 532 818	9 th LS
44 239	1980-01-01	00:00:00	00:00:19	19				2 524 521 600	0	315 532 819		
44 244	1980-01-06	00:00:00	1980-01-06 00:00:19	19	0	0	0	2 524 953 600	0	315 964 819	GPS Epoch	
44 785	1981-06-30	23:59:59	1981-07-01 00:00:18	19	46 828 799			259 199	2 571 782 399	1	362 793 618	
		23:59:60		00:00:19	19	46 828 800	77		259 200	2 571 782 400	1	362 793 619
44 786	1981-07-01	00:00:00	00:00:20	20	46 828 801			259 201	2 571 782 400	0	362 793 620	
45 150	1982-06-30	23:59:59	1982-07-01 00:00:19	20	78 364 800			345 600	2 603 318 399	1	394 329 619	
		23:59:60		00:00:20	20	78 364 801	129		345 601	2 603 318 400	1	394 329 620
45 151	1982-07-01	00:00:00	00:00:21	21	78 364 802			345 602	2 603 318 400	0	394 329 621	
45 515	1983-06-30	23:59:59	1983-07-01 00:00:19	21	109 900 801			432 001	2 634 854 399	1	425 865 620	
		23:59:60		00:00:21	21	109 900 802	181			2 634 854 400	1	425 865 621
45 516	1983-07-01	00:00:00	00:00:22	22	109 900 803			432 003	2 634 854 400	0	425 865 622	

UTC			TAI	TAI-UTC	GPS			NTP		PTP seconds	Comment
DN	YYYY-MM-DD	hh:mm:ss	YYYY-MM-DD hh:mm:ss		Seconds	Wk #	Sec # in Wk	LS pending ↓			
46 246	1985-06-30	23:59:59	1985-07-01 00:00:21	22	173 059 202	286	86 402	2 698 012 799	1	489 024 021	
		23:59:60		00:00:22	22		173 059 203	86 403	2 698 012 800	1	489 024 022
46 247	1985-07-01	00:00:00	00:00:23	23	173 059 204		86 404	2 698 012 800	0	489 024 023	
47 160	1987-12-31	23:59:59	1988-01-01 00:00:22	23	252 028 803	416	432 003	2 776 982 399	1	567 993 622	
		23:59:60		00:00:23	23		252 028 804	432 004	2 776 982 400	1	567 993 623
47 161	1988-01-01	00:00:00	00:00:24	24	252 028 805		432 005	2 776 982 400	0	567 993 624	
47 891	1989-12-31	23:59:59	1990-01-01 00:00:23	24	315 187 204	521	86 404	2 840 140 799	1	631 152 023	
		23:59:60		00:00:24	24		315 187 205	86 405	2 840 140 800	1	631 152 024
47 892	1990-01-01	00:00:00	00:00:25	25	315 187 206		86 406	2 840 140 800	0	631 152 025	
48 256	1990-12-31	23:59:59	1991-01-01 00:00:24	25	346 723 205	573	172 805	2 871 676 799	1	662 688 024	
		23:59:60		00:00:25	25		346 723 206	172 806	2 871 676 800	1	662 688 025
48 257	1991-01-01	00:00:00	00:00:26	26	346 723 207		172 807	2 871 676 800	0	662 688 026	
48 803	1992-06-30	23:59:59	1992-01-01 00:00:25	26	393 984 006	651	259 206	2 918 937 599	1	709 948 825	
		23:59:60		00:00:26	26		393 984 007	259 207	2 918 937 600	1	709 948 826
48 804	1992-07-01	00:00:00	00:00:27	27	393 984 008		259 208	2 918 937 600	0	709 948 827	
49 168	1993-06-30	23:59:59	1993-07-01 00:00:26	27	425 520 006	703	345 606	2 950 473 599	1	741 484 826	
		23:59:60		00:00:27	27		425 520 007	345 607	2 950 473 600	1	741 484 827
49 169	1993-07-01	00:00:00	00:00:28	28	425 520 008		345 608	2 950 473 600	0	741 484 828	
49 533	1994-06-30	23:59:59	1994-07-01 00:00:27	28	457 056 008	755	432 008	2 982 009 599	1	773 020 827	
		23:59:60		00:00:28	28		457 056 009	432 009	2 982 009 600	1	773 020 828
49 534	1994-07-01	00:00:00	00:00:29	29	457 056 010		432 010	2 982 009 600	0	773 020 829	
50 082	1995-12-31	23:59:59	1996-01-01 00:00:28	29	504 489 609	834	86409	3 029 443 199	1	820 454 428	
		23:59:60		00:00:29	29		504 489 610	86410	3 029 443 200	1	820 454 429
50 083	1996-01-01	00:00:00	00:00:30	30	504 489 611		86411	3 029 443 200	0	820 454 430	
50 629	1997-06-30	23:59:59	1997-07-01 00:00:29	30	551 750 410	912	172 810	3 076 703 999	1	867 715 229	
		23:59:60		00:00:30	30		551 750 411	172 811	3 076 704 000	1	867 715 230
50 630	1997-07-01	00:00:00	00:00:31	31	551 750 412		172 812	3 076 704 000	0	867 715 231	
51 178	1998-12-31	23:59:59	1999-01-01 00:00:30	31	599 184 011	990	432 011	3 124 137 599	1	915 148 830	
		23:59:60		00:00:31	31		599 184 012	432 012	3 124 137 600	1	915 148 831
51 179	1999-01-01	00:00:00	00:00:32	32	599 184 013		432 013	3 124 137 600	0	915 148 832	
53 735	2005-12-31	23:59:59	2006-01-01 00:00:31	32	820 108 812	1 356	12	3 345 062 399	1	1 136 073 631	
		23:59:60		00:00:32	32		820 108 813	13	3 345 062 400	1	1 136 073 632
53 736	2006-01-01	00:00:00	00:00:33	33	820 108 814		14	3 345 062 400	0	1 136 073 633	