

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" format, and the time of day in "hh:mm:ss" format.
- 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 "Leap Indicator" field, LI. If LI = 01, the least minute of the current UTC day has 61 seconds. (If LI = 10, a negative leap second is pending.) After the leap second, LI = 00.
- 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. 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	Leap Indicator ↓			
	1900-01-01	00:00:00							0	00		NTP Epoch
	1970-01-01	00:00:00							2 208 988 800	00	0	PTP Epoch
41 317	1972-01-01	00:00:00	1972-01-01	00:00:10	10				2 272 060 800	00	63 072 010	UTC Epoch
41 498	1972-06-30	23:59:59	1972-07-01	00:00:09	10				2 287 785 599	01	78 796 809	
		23:59:60		00:00:10	10				2 287 785 600	01	78 796 810	1 st LS
41 499	1972-07-01	00:00:00		00:00:11	11				2 287 785 600	00	78 796 811	
41 682	1972-12-31	23:59:59	1973-01-01	00:00:10	11				2 303 683 199	01	94 694 410	
		23:59:60		00:00:11	11				2 303 683 200	01	94 694 411	2 nd LS
41 683	1973-01-01	00:00:00		00:00:12	12				2 303 683 200	00	94 694 412	
42 047	1973-12-31	23:59:59	1974-01-01	00:00:11	12				2 335 219 199	01	126 230 411	
		23:59:60		00:00:12	12				2 335 219 200	01	126 230 412	3 rd LS
42 048	1974-01-01	00:00:00		00:00:13	13				2 335 219 200	00	126 230 413	
42 412	1974-12-31	23:59:59	1975-01-01	00:00:12	13				2 366 755 199	01	157 766 412	
		23:59:60		00:00:13	13				2 366 755 200	01	157 766 413	4 th LS
42 413	1975-01-01	00:00:00		00:00:14	14				2 366 755 200	00	157 766 414	
42 777	1975-12-31	23:59:59	1976-01-01	00:00:13	14				2 398 291 199	01	189 302 413	
		23:59:60		00:00:14	14				2 398 291 200	01	189 302 414	5 th LS
42 778	1976-01-01	00:00:00		00:00:15	15				2 398 291 200	00	189 302 415	
43 143	1976-12-31	23:59:59	1977-01-01	00:00:14	15				2 429 913 599	01	220 924 814	
		23:59:60		00:00:15	15				2 429 913 600	01	220 924 815	6 th LS
43 144	1977-01-01	00:00:00		00:00:16	16				2 429 913 600	00	220 924 816	
43 508	1977-12-31	23:59:59	1978-01-01	00:00:15	16				2 461 449 599	01	252 460 815	
		23:59:60		00:00:16	16				2 461 449 600	01	252 460 816	7 th LS
43 509	1978-01-01	00:00:00		00:00:17	17				2 461 449 600	00	252 460 817	

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	Leap Indicator ↓			
43 873	1978-12-31	23:59:59	1979-01-01	00:00:16	17				2 492 985 599	01	283 996 816	
		23:59:60		00:00:17	17				2 492 985 600	01	283 996 817	8 th LS
43 874	1979-01-01	00:00:00		00:00:18	18				2 492 985 600	00	283 996 818	
44 238	1979-12-31	23:59:59	1980-01-01	00:00:17	18				2 524 521 599	01	315 532 817	
		23:59:60		00:00:18	18				2 524 521 600	01	315 532 818	9 th LS
44 239	1980-01-01	00:00:00		00:00:19	19				2 524 521 600	00	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	00	315 964 819	GPS Epoch
44 785	1981-06-30	23:59:59	1981-07-01	00:00:18	19	46 828 799	77	259 199	2 571 782 399	01	362 793 618	
		23:59:60		00:00:19	19	46 828 800		259 200	2 571 782 400	01	362 793 619	10 th LS
44 786	1981-07-01	00:00:00		00:00:20	20	46 828 801		259 201	2 571 782 400	00	362 793 620	
45 150	1982-06-30	23:59:59	1982-07-01	00:00:19	20	78 364 800	129	345 600	2 603 318 399	01	394 329 619	
		23:59:60		00:00:20	20	78 364 801		345 601	2 603 318 400	01	394 329 620	11 th LS
45 151	1982-07-01	00:00:00		00:00:21	21	78 364 802		345 602	2 603 318 400	00	394 329 621	
45 515	1983-06-30	23:59:59	1983-07-01	00:00:19	21	109 900 801	181	432 001	2 634 854 399	01	425 865 620	
		23:59:60		00:00:21	21	109 900 802			2 634 854 400	01	425 865 621	12 th LS
45 516	1983-07-01	00:00:00		00:00:22	22	109 900 803		432 003	2 634 854 400	00	425 865 622	
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	01	489 024 021	
		23:59:60		00:00:22	22	173 059 203		86 403	2 698 012 800	01	489 024 022	13 th LS
46 247	1985-07-01	00:00:00		00:00:23	23	173 059 204		86 404	2 698 012 800	00	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	01	567 993 622	
		23:59:60		00:00:23	23	252 028 804		432 004	2 776 982 400	01	567 993 623	14 th LS
47 161	1988-01-01	00:00:00		00:00:24	24	252 028 805		432 005	2 776 982 400	00	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	01	631 152 023	
		23:59:60		00:00:24	24	315 187 205		86 405	2 840 140 800	01	631 152 024	15 th LS
47 892	1990-01-01	00:00:00		00:00:25	25	315 187 206		86 406	2 840 140 800	00	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	01	662 688 024	
		23:59:60		00:00:25	25	346 723 206		172 806	2 871 676 800	01	662 688 025	16 th LS
48 257	1991-01-01	00:00:00		00:00:26	26	346 723 207		172 807	2 871 676 800	00	662 688 026	

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	Leap Indicator ↓			
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	01	709 948 825	
		23:59:60		00:00:26	26	393 984 007		259 207	2 918 937 600	01	709 948 826	17 th LS
48 804	1992-07-01	00:00:00	00:00:27	27	393 984 008	259 208		2 918 937 600	00	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	01	741 484 826	
		23:59:60		00:00:27	27	425 520 007		345 607	2 950 473 600	01	741 484 827	18 th LS
49 169	1993-07-01	00:00:00	00:00:28	28	425 520 008	345 608		2 950 473 600	00	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	01	773 020 827	
		23:59:60		00:00:28	28	457 056 009		432 009	2 982 009 600	01	773 020 828	19 th LS
49 534	1994-07-01	00:00:00	00:00:29	29	457 056 010	432 010		2 982 009 600	00	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	01	820 454 428	
		23:59:60		00:00:29	29	504 489 610		86410	3 029 443 200	01	820 454 429	20 th LS
50 083	1996-01-01	00:00:00	00:00:30	30	504 489 611	86411		3 029 443 200	00	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	01	867 715 229	
		23:59:60		00:00:30	30	551 750 411		172 811	3 076 704 000	01	867 715 230	21 st LS
50 630	1997-07-01	00:00:00	00:00:31	31	551 750 412	172 812		3 076 704 000	00	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	01	915 148 830	
		23:59:60		00:00:31	31	599 184 012		432 012	3 124 137 600	01	915 148 831	22 nd LS
51 179	1999-01-01	00:00:00	00:00:32	32	599 184 013	432 013		3 124 137 600	00	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	01	1 136 073 631	
		23:59:60		00:00:32	32	820 108 813		13	3 345 062 400	01	1 136 073 632	23 rd LS
53 736	2006-01-01	00:00:00	00:00:33	33	820 108 814	14		3 345 062 400	00	1 136 073 633		