SMPTE STANDARD

for Television — Transmission of Date and Time Zone Information in Binary Groups of Time and Control Code

1 Scope

This standard specifies a coding technique for the transmission of date and time zone information in the user groups of a time and control code signal. A two-digit hexadecimal code in a pair of binary groups specifies the time zone and the format for the date encoding in the remaining six binary groups. Date information is encoded either as six decimal digits to display the date in the YYMMDD format or as six decimal digits in the modified Julian date (MJD) format.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI/SMPTE 262M-1995, Television, Audio and Film -- Binary Groups of Time and Control Codes — Storage and Transmission of Data

SMPTE 12M-1999, Television, Audio and Film – Time and Control Code

ISO 8601:1988, Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times

ITU-R TF.457-1, Use of the Modified Julian Date by the Standard Frequency and Time-Signal Services

3 Glossary

3.1 coordinated universal time or universal time, coordinated (UTC): UTC is an international atomic time standard and is the basis for civil time. It is the current term for what was commonly refererred to as Greenwich meridian time (GMT). Zero (0) hours UTC is midnight in Greenwich, England, which lies on the zero longitudinal meridian.

3.2 daylight saving time: The civil time observed when daylight saving is adopted in a country or region.

3.3 Julian date (JD): The Julian day number is a count of days that have elapsed since Greenwich mean noon on 1 January 4713 B.C., Julian proleptic calendar.

3.4 modified Julian date (MJD): The MJD is an abbreviated version of the Julian date (JD) dating method. It is defined as MJD = JD-2400000.5. An MJD day thus begins at midnight, civil date.

3.5 standard time: The civil time adopted for a country or region.

4 Date and time zone in binary groups

Two binary groups (BG7 and BG8) encode the time zone and define the format for the encoding of the date in the remaining six binary groups. The date, as specified by a date format flag bit in binary group 8, may be either six decimal digits in YYMMDD format or a six-decimal digit modified Julian date (MJD).

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4.1 Time zone, date format, and time precision in binary groups 7 and 8

Binary groups 7 and 8 as detailed in table 1 define the format of the date encoded in binary groups 1 through 6, the time zone and time precision (refer to table 2).

4.1.1 MJD format flag bit

If this bit is logical zero, then the date is specified as six decimal digits in the format YYMMDD (see 4.2). The time address represents the local clock time that has been offset from coordinated universal time (UTC) as specified by the time zone offset. If this bit is logical one, then the date is specified as MJD encoded as six BCD digits (see 4.3). The time address portion of time code represents UTC without any offset. The time zone offset and daylight saving time flag are provided for information only. They may be used to calculate and display time in the local time.

4.1.2 Unassigned bit

One bit in binary group 8 is unassigned and reserved for future definition. This bit should be set to zero until it is defined.

4.1.3 Time zone coding and time precision coding

Six bits in binary groups 7 and 8 code the local time zone or time precision as defined in table 2. This table also includes entries to specify time precision as defined in 4.1.4.

4.1.4 Time precision

Table 2 includes four entries for time precision. When one of these codes is selected, UTC time is implied. Table 3 shows these time precision classes.

For classes 1, 2 and 3, the video frequencies and frame rate are adjusted to fit an integral number of video frames in a 24-hour period.

For classes 1 and 2 with video with a nominal frame rate of 29.97 Hz, there will be a drift of two frames between the clock time and the time address. For class 2, this is compensated by a leap drop frame counting mode in which the normally dropped frame counts 23:59:00:00 and 23:59:00:01 are not dropped. For class 1, this is corrected by a time jam sync at a user selected time.

For class 3, the number of time code counts matches the number of video frames in a 24-hour period.

For time code referenced to video with a frame rate of 29.97 Hz, the drop frame counting mode shall be used.

4.1.5 Binary group flags

Binary group flag assignments conforming to the values shown in table 4 shall signal that the date and time zone are encoded using the methods described in this standard. These assignments may also signal that the time address is referenced to a precision clock time reference as described in SMPTE 12M.

Table 1 – Date format and time zone offset coding in binary groups

Binary group	Assignation	Description
7.0 7.1 7.2 7.3 8.0 8.1	TZ-0 TZ-1 TZ-2 TZ-3 TZ-4 TZ-5	1's bit 2's bit 4's bit 8's bit 16's bit 32's bit Time zone code 0-63 (00-3F$_{HEX}$) see table 2
8.2	Unassigned	Reserved for future use; set to zero until assigned.
8.3	MJD flag	0 = YYMMDD format 1 = MJD (6-digit) format

Table 2 – Time zone offset and time precision coding

Offset					Offset			
Code	Hours	Standard time (see note 2)	Daylight saving		Code	Hours	Standard time (see note 2)	Daylight saving
00	UTC	Greenwich			0A	UTC-00:30		
01	UTC-01:00	Azores			0B	UTC-01:30		
02	UTC-02:00	Mid-Atlantic			0C	UTC-02:30		Newfoundland
03	UTC-03:00	Buenos Aires	Halifax		0D	UTC-03:30	Newfoundland	
04	UTC-04:00	Halifax	New York		0E	UTC-04:30		
05	UTC-05:00	New York	Chicago		0F	UTC-05:30		
06	UTC-06:00	Chicago	Denver		1A	UTC-06:30		
07	UTC-07:00	Denver	Los Angeles		1B	UTC-07:30		
08	UTC-08:00	Los Angeles			1C	UTC-08:30		
09	UTC-09:00	Alaska			1D	UTC-09:30	Marquesa Islands	
10	UTC-10:00	Hawaii			1E	UTC-10:30		
11	UTC-11:00	Midway Island			1F	UTC-11:30		
12	UTC-12:00	Kwaialein			2A	UTC+11:30	Norfolk Island	
13	UTC+13:00		New Zealand		2B	UTC+10:30	Lord Howe Is.	
14	UTC+12:00	New Zealand			2C	UTC+09:30	Darwin	
15	UTC+11:00	Solomon Islands			2D	UTC+08:30		
16	UTC+10:00	Guam			2E	UTC+07:30		
17	UTC+09:00	Tokyo			2F	UTC+06:30	Rangoon	
18	UTC+08:00	Beijing			3A	UTC+05:30	Bombay	
19	UTC+07:00	Bangkok			3B	UTC+04:30	Kabul	
20	UTC+06:00	Dhaka			3C	UTC+03:30	Tehran	
21	UTC+05:00	Islamabad			3D	UTC+02:30		
22	UTC+04:00	Abu Dhabi			3E	UTC+01:30		
23	UTC+03:00	Moscow			3F	UTC+00:30		
24	UTC+02:00	Eastern Europe			32	UTC+12:45	Chatham Island	
25	UTC+01:00	Central Europe			33	Undefined	Reserved; do not use	
26	Undefined	Reserved; do not use			34	Undefined	Reserved; do not use	
27	Undefined	Reserved; do not use			35	Undefined	Reserved; do not use	
28	TP-3	Time precision class 3			36	Undefined	Reserved; do not use	
29	TP-2	Time precision class 2			37	Undefined	Reserved; do not use	
30	TP-1	Time precision class 1			38	User defined time offset		
31	TP-0	Time precision class 0			39	Undefined	Unknown	Unknown

NOTES

1 The frames that are not dropped in precision class 2 are the last two frames in a 24-hour day that are dropped in normal drop frame. These values are subject to revision in the course of future development.

2 The locations shown are informative to aid the reader.

4.2 Date as binary coded decimal digits

When the date in the YYMMDD format is used, the date information shall be encoded as six BCD digits in binary groups 1 to 6 as specified in table 5.

NOTE – If definition of the century is important, then the date should be encoded as a modified Julian date as described in 4.3.

4.3 Modified Julian date

When the date in the modified Julian date format is used, the date information shall be encoded as six BCD digits in ascending order of magnitude in binary groups 1 to 6 as specified in table 6.

4.4 Time and date coordination

The date shall increment at the time address midnight rollover from 23:59:59:2x to 00:00:00:00. This implies that the date and time address are coordinated and are applicable to the local time zone or UTC, as specified by the MJD format flag and time zone offset code (see 4.1).

Table 3 – Time precision classes

Precision class	Maximum deviation from UTC	Remarks
0	± 3 frames	Minimum of 1 jam sync to UTC per day.
1	± 2 frames	For NTSC video, the subcarrier is adjusted by --0.82 Hz. Minimum of 1 jam sync to UTC per day at user defined time.
2	± 2 frames	For NTSC video, the subcarrier is adjusted by --0.82 Hz. Leap drop frame counting mode (frames [23:59:00:00] and [23:59:00:01] are not dropped. Note 1. Minimum of 1 jam sync to UTC per day.
3	± 1 frame	For NTSC video, the subcarrier is adjusted by --3.58 Hz. Minimum of 1 jam sync to UTC per day.

Table 4 – Binary group flag assignments for date and time zone encoded in binary groups

BGF2	BGF1	BGF0	Time address reference
1	0	0	Unspecified
1	1	0	Precision clock
NOTE -- Refer to SMPTE 12M for LTC and VITC bit numbers for 24, 25, and 30-frame-per-second systems.			

Table 5 – Date data in binary groups

Binary group	Assignation	Value	Description
1	D	0-9	Day units
2	D	0-3	Day tens
3	M	0-9	Month units
4	M	0,1	Month tens
5	Y	0-9	Year units
6	Y	0-9	Year tens

Table 6 – Modified Julian date data in binary groups

Binary group	Assignation	Value	Comments
1	MJD units	0-9	
2	MJD tens	0-9	
3	MJD hundreds	0-9	
4	MJD thousands	0-9	
5	MJD ten thousands	0-9	
6	MJD hundred thousands	0-9	Will be zero until the year 2131

Annex A (informative)
Differences between GPS time and UTC time

Users are cautioned to apply any necessary corrections to adjust their chosen clock reference to UTC. GPS satellite time reference signals have a known published offset from UTC and manufacturers of time code systems based on GPS signals must account for the current offset and make provisions for current and future leap second corrections.

Annex B (informative)
Additional data in binary groups

Additional data may be encoded into the binary groups by multiplexing data over several frames. When this is implemented, the binary group flags will be changed to the appropriate flag combination for the binary group encoding in use.

ANSI/SMPTE 262M describes a method using a page/line index to identify and multiplex a wide variety of data types into the binary groups.

Annex C (informative)
Modified Julian date (MJD)

The modified Julian date (MJD) is an abbreviated version of the Julian date (JD) dating method which has been in use by astronomers, geophysicists, chronologers, and others who need to have an unambiguous dating system based on continuing day counts.

The MJD is defined as the JD minus 2400000.5. It should be noted that JD increments at noon while MJD increments at midnight. MJD is thus a continuous count of the number of days that have elapsed since 17 November 1858.

MJD is often more useful than conventional calendar dates for record keeping over long periods of time, since the MJDs of two events can easily be subtracted to determine the time difference in days. Since the MJD is a linear counting of days, there is no requirement to differentiate between days, months, and years. As an example, the MJD for 1 January 1995 is 49718.

Usually, the MJD is specified as a decimal number with five significant digits. With five digits, the count is good until the year 2132. Since this standard extends to six digits, this precludes any foreseeable problems with future date rollovers from 99,999 to 00,000.

Annex D (informative)
Bibliography

SMPTE RP 188-1996, Transmission of Time Code and Control Code in the Ancillary Data Space of a Digital Television Data Stream

SMPTE RP 196-1997, Transmission of LTC and VITC Data as HANC Packets in Serial Digital Television Interfaces