SMPTE ST 309:2012
Revision of SMPTE 309M-1999

SMPTE STANDARD

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

Table of Contents **Page**

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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Operations Manual.

SMPTE ST 309 was prepared by Technology Committee 33TS.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

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 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:”

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 12-1:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 12M-1-2008). Documents with the same root number (e.g. 12-1) and publication year (e.g. 2008) are functionally identical.

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

SMPTE ST 12-1:2008, Television — Time and Control Code

ISO 8601:2004, Data Elements and Interchange Formats — Information Interchange — Representation of Dates and Times

ITU-R TF.457-2 1997, Use of the Modified Julian Date by the Standard Frequency and Time-Signal Services

4 Glossary

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 referred to as Greenwich Mean Time (GMT). Zero (0) hours UTC is midnight in Greenwich, England, which lies on the zero longitudinal meridian.

Daylight Saving Time (DST): The civil time observed when daylight saving is adopted in a country or region.

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.

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.

Standard Time: The civil time adopted for a country or region.

5 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).

Note: The bit positions of the binary groups are described in Table 11 of SMPTE ST 12-1 for LTC and VITC applications and in Table 6 of SMPTE ST 12-2 for ATC applications.

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

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 (00-3FHEX) — see Table 2
8.2	DST flag	0 = DST not in effect 1 = DST in effect.
8.3	MJD flag	0 = YYMMDD format 1 = MJD (6-digit) format

5.1 Time Zone, Date Format and Daylight Saving Time 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, daylight saving time observance and the time zone (refer to Table 2).

5.1.1 MJD format flag bit

If this bit is logical zero, then the date is specified as six decimal digits in the format YYMMDD (see Section 5.2). 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 Section 5.3). 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.

Note: When BCD dates are carried (MJD=0) legacy readers that are not ST 309 aware can display the correct local time and could display an intelligible date. When Modified Julian Date dates are carried (MJD=1) only readers that are ST 309 aware can decode the correct date, so to assure alignment of midnight rollover of date and time are concurrent, UTC is carried in the time bits

5.1.2 Daylight Saving Time (DST) flag bit

One bit in binary group 8 is used to signal that Daylight saving time is in effect

5.1.3 Time zone coding

Six bits in binary groups 7 and 8 code the local time zone as defined in Table 2.

Table 2 – Time zone offset and time precision coding

Offset		Standard time (see note 2)	Daylight saving
Code	Hours		
00	UTC	Greenwich	
01	UTC-01:00	Azores	
02	UTC-02:00	Mid-Atlantic	
03	UTC-03:00	Buenos Aires	Halifax
04	UTC-04:00	Halifax	New York
05	UTC-05:00	New York	Chicago
06	UTC-06:00	Chicago	Denver
07	UTC-07:00	Denver	Los Angeles
08	UTC-08:00	Los Angeles	
09	UTC-09:00	Alaska	
10	UTC-10:00	Hawaii	
11	UTC-11:00	Midway Island	
12	UTC-12:00	Kwaialein	
13	UTC+13:00		New Zealand
14	UTC+12:00	New Zealand	
15	UTC+11:00	Solomon Islands	
16	UTC+10:00	Guam	
17	UTC+09:00	Tokyo	
18	UTC+08:00	Beijing	
19	UTC+07:00	Bangkok	
20	UTC+06:00	Dhaka	
21	UTC+05:00	Islamabad	
22	UTC+04:00	Abu Dhabi	
23	UTC+03:00	Moscow	
24	UTC+02:00	Eastern Europe	Central Europe
25	UTC+01:00	Central Europe	United Kingdom
26	Undefined	Reserved; do not use	
27	Undefined	Reserved; do not use	
28			
29	Undefined		
30		Deprecated	
31			

Offset		Standard time (see note 2)	Daylight saving
Code	Hours		
0A	UTC-00:30		
0B	UTC-01:30		
0C	UTC-02:30		Newfoundland
0D	UTC-03:30	Newfoundland	
0E	UTC-04:30		
0F	UTC-05:30		
1A	UTC-06:30		
1B	UTC-07:30		
1C	UTC-08:30		
1D	UTC-09:30	Marquesa Islands	
1E	UTC-10:30		
1F	UTC-11:30		
2A	UTC+11:30		
2B	UTC+10:30		
2C	UTC+09:30		
2D	UTC+08:30		
2E	UTC+07:30		
2F	UTC+06:30		
3A	UTC+05:30		
3B	UTC+04:30		
3C	UTC+03:30		
3D	UTC+02:30		
3E	UTC+01:30		
3F	UTC+00:30		
32	UTC+12:45	Chatham Island	
33	Undefined	Reserved; do not use	
34	Undefined	Reserved; do not use	
35	Undefined	Reserved; do not use	
36	Undefined	Reserved; do not use	
37	Undefined	Reserved; do not use	
38	User defined time offset		
39	Undefined	Unknown	Unknown

Notes:

1 The use of codes 28 to 31 to signal time precision information is deprecated in this revision of the standard.

2 The locations shown are informative to aid the reader.

5.1.4 Binary group flags

Binary group flag assignments conforming to the values shown in table 3 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 ST 12-1.

Table 3 – 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 ST 12-1 for LTC and VITC bit numbers for 24, 25, and 30-frame-per-second systems.			

5.2 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 4.

Note: If definition of the century is important, then the date can be encoded as a modified Julian date as described in Section 5.3.

5.3 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 5.

5.4 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 Section 5.1).

Table 4 – 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 5 – Modified Julian date data in binary groups

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

Annex A Differences between GPS Time and UTC Time (Informative)

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 Additional Data in Binary Groups (Informative)

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

Annex C Modified Julian Date (MJD) (Informative)

The modified Julian date (MJD) is an abbreviated version of the Julian date (JD) dating method which has been in use by astronomers, geophysicists, chronologists, 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. Note 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 Bibliography (Informative)

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 12-2:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 12M-2-2008). Documents with the same root number (e.g. 12-2) and publication year (e.g. 2008) are functionally identical.

SMPTE ST 12-2:2008, Transmission of Time Code and Control Code in the Ancillary Data Space of a Digital Television Data Stream

SMPTE ST 262:1995 (Archived 2011), Television, Audio and Film — Binary Groups of Time and Control Codes — Storage and Transmission of Data

SMPTE EG 35:2012, Time and Control Code Time Address Clock Precision for Television, Audio and Film

SMPTE EG 40:2012, Conversion of Time Values Between SMPTE ST 12-1 Time Code, MPEG-2 PCR Time Base and Absolute Time