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RECOMMENDED STANDARDS FOR DIGITAL TAPE FORMATS[1]

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RECOMMENDATIONS OF THE FIELD TAPE FORMAT SUBCOMMITTEE

INTRODUCTION

Digital recording and processing of seismic information has increased very rapidly in the last five years. This advancement, although proving successful over previous techniques in many cases, has not been without problems. One of the problems faced by the contractor and major company alike has been the recording and subsequent processing of multi-formats on digital tape. The SEG, realizing this dilemma, set up a Digital Recording Standards Committee. At the second meeting of this committee in September 1966, a subcommittee was appointed to recommend a standard 9-channel field tape format. The recommendations of that subcommittee are included in this report.

The seismic record file was divided into a header block which contains constant identification information pertaining to the seismic record and the seismic data block(s) which contains the data values of the seismic channels.

Each element considered for standardization was thoroughly discussed and consensus of the subcommittee was reached before placement in the format. However, one particular feature–how should gain information be recorded–dictated the necessity of establishing two standard seismic data block formats. A common header block (Figure 1) is utilized with either type of seismic data block(s). For the purpose of discussion, the two formats are labeled Format A (Figure 2) and Format B (Figure 3).

The subcommittee would like to acknowledge the support of the Advisory Council, a group of field system manufacturers attached to the subcommittee. These organizations supplied opinions on the preliminary format designs which were most helpful in shaping these final recommendations.

These two papers are the results of work by two subcommittees of the Digital Standards Committee of the SEG. The first paper recommends standard digital tape formats for 9-track field recording of seismic data, and the second paper recommends a tape format to be used for the exchange of either field or processed data. These recommendations have a number of options to permit their acceptance by the industry. It is hoped that they will find general use by those who prefer 9-track formats. The universal use of these formats will permit a more efficient use of manpower and funds available to the industry with a resultant lowering of the cost of doing business.
These two papers should not be construed that the Committee prefers 9-track over 21-track tapes. The latter tape formats are already standardized and the Committee's efforts were directed toward the 9-track where there appeared to be a danger of proliferation of formats.

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[3] Chairman, Subcommittee on Field Tape Formats (Gulf Oil Corporation, Houston, Texas).

[4] Chairman, Subcommittee on File (or Exchange) Tape Formats (Atlantic Richfield Company, Dallas, Texas).

DESCRIPTION OF FEATURES COMMON TO BOTH FORMATS

The following is a general description of the recommendations common to both of the proposed formats:

1. Hub size will be IBM standard.
2. The recording density will be 800 bpi with a ±10 percent tolerance.
3. Data values are to be written in binary notation in two bytes with vertical parity odd.
4. The most significant bit of the data value will be the sign bit in the zero (bit number) bit of the first byte, and the least significant bit is in the sixth (bit number) bit of the second byte.
5. Negative numbers are to be recorded in either one's complement or in two's complement. (Format A requires data to be in one's complement.)
6. The NRZI method will be used to write the data words.
7. Either format may be written in a gapped or gapless format. In gapped mode of recording all seismic data blocks must contain the same number of integer data scans and be separated by standard IBM inter-record gaps.
8. Sample interval may be 1, 2, or 4 milliseconds. If longer intervals are necessary, the increments should be divisible by two, i.e., 6 or 8 milliseconds. (One millisecond not included when channel number exceeds 30 channels.)
9. A gap of at least 0.6 inch will separate the header block from the seismic data block(s).
10. An end-of-file mark will be recorded after each seismic record file with an additional end-of-file mark after the last seismic record file on the tape.
11. The formats provide twenty-four (24) seismic data channels plus auxiliary channels. In Format B the number of seismic data channels may be expanded in increments of four to any desired amount pursuant to recording capabilities.
12. Tape specifications, longitudinal parity and cyclic redundancy checks, track dimensions and numbering, and format gaps are to be compatible with IBM specifications.

DESCRIPTION OF HEADER BLOCK

Each seismic record file will start with the header block shown in Figure 1. The header block is separated from its associated seismic data block(s) by an inter-record gap of at least 0.6 inch in length. The first header block on tape will begin at least 3.5 inches past the aft edge of the load-point reflective marker.

Each byte will accommodate two binary coded decimal (BCD) digits. The most significant digit (MSD) position will be in bit numbers 0, 1, 2, and 3, with respective decimal values of 8, 4, 2, and 1. The least-significant (LSD) position will be in bit numbers 4, 5, 6 and 7, with respective decimal values of 8, 4, 2, and 1.

Numbered subscripts on code letters in tape format refer to decimal digit position, e.g., Y_1–high order position of format code; Y_4–low order position for format code. The format code number 0273 will be written as follows: $Y_1 = 0$; $Y_2 = 2$; $Y_3 = 7$; $Y_4 = 3$.

Bit numbers 0, 1, and 2 of odd-numbered bytes of the pre-record gain bytes are channel identifier codes. This code is used to identify usage of each channel recorded.

Bit No.			**Type Channel**
0	**1**	**2**	
0	0	0	Unused channel
1	0	0	Water-break channel
0	1	0	Time-break channel
1	1	0	Gain channel
0	0	1	Seismic channel
1	0	1	Time counter
0	1	1	Uphole channel
1	1	1	Other

Bit positions 3 through 7 are reserved for pre-

record gain settings. This information is in binary form with the most significant bit in bit no. 3 and the least significant bit in bit no. 7.

For each channel, the first of the two bytes is used for either the fixed gain portion of binary gain amplifiers or final gain amplifier settings.

The second byte is for the initial setting of the variable portion of binary gain amplifiers or the early gain amplifier settings.

Notes: If only the standard portion of the header block is used, the minimum length of the block must be 16 bytes even if the header information is contained in less than 16 bytes.

If a user desires to utilize any part of the optional section, then the unused bits should be written as zeros with the proper bit parity and the length of the header block will equal *J* + 24 bytes.

Should information not defined in the standard or optional section be required, then these data must be recorded following the optional portion. When this extension is implemented, it will be necessary to describe these data and to obtain a new format code from the SEG Standards Committee.

DESCRIPTION OF FORMAT A–(30 CHANNELS)

Figure 2 shows the detailed arrangement of the data on the magnetic tape. Each data value of a seismic channel is recorded in two successive bytes on tape. The eight bits of a byte plus one parity check bit are recorded simultaneously on the 9 tracks of the tape at the density of 800 bpi. The data is located in the most significant 15 bits of the 2-byte "word." If a particular field recorder uses less than 15 bits for data, the most significant bit positions will be used. The 16th bit in the word is reserved for a gain change indication to be used with binary gain amplifiers. Auxiliary channels also use two bytes each, but the bit configuration is specialized to the types of data being recorded. This does not in any way preclude the use of auxiliary channels (except channel 30) as additional seismic channels. All the seismic channels and all the auxiliary channels are sampled and recorded once during each data-scan period.

Header Block Allocation		
Byte No.	Format Letters	Description
A. Standard Portion–16 Bytes		
1	F_1, F_2	4-digit file number
2	F_3, F_4	
3	Y_1, Y_2	4-digit format code assigned by SEG upon filing of format
4	Y_3, Y_4	
5	K_1, K_2	12-digit data identification constants (e.g., date, line no., reel no., etc.)
6	K_3, K_4	
7	K_5, K6	
8	K_7, K8	
9	K_9, K_{10}	
10	K_{11}, K_{12}	
11	B_1, B_2	Number of bytes per data scan
12 MSD	B_3	
12 LSD	I	Sample of interval in integral number of milliseconds
13	M_1, M_2	2-digit manufacturers code (See Appendix A)
14	M_3, M_4	6-digit equipment serial number
15	M_5, M_6	
16	M_7, M_8	
B. Optional Portion		
17	R_1, R_2	Length of record in seconds
18	J	Amplifier gain control mode 8 = binary gain 4 = programmed gain 2 = ganged AGC 1 = individual AGC 15 =other

18	Z	Type of record 8 = shot 4 = shot bridle 2 = test 1 = other
19	LC_1, LC_2	2-digit low cut filter setting
20	LS	Low cut filter slope setting in db/octave-BCD number representing slope (to calculate actual slope multiply number by db/octave)
20 LSD	LSD	All zeros
21	HC_1, HC_2	3-digit high cut filter setting
22	HC_3	
22 LSD	HS	High cut filter slope setting in db/octave–BCD number representing slope (to calculate actual slope multiply number y 6 db/octave)
23	S_1, S_2	2-digit special filter setting (rejection or others)
24 MSD	A	Alias filter setting
24 LSD		All zeros
25		Pre-record gain settings and channel identifiers (fixed gain-odd
		Numbered bytes)
26		Pre-record gain settings (early gain–even numbered bytes)
	O	
	O	
	C	
	O	
24+J		

Where for Format A:

J= (No. Bytes/Scan)–(No. of Bytes for Binary Gain and Sync)

For Format B:

J= (No. Bytes/Scan)–(No. of Bytes for Binary Gain and Sync)+(2 Bytes)

The two bytes were added to Format B to make the header blocks (Format A, Format B) of equal byte length.

(For a typical 24-channel system with 6 auxiliary traces, "J" will equal 60 bytes)

In Format A, the data portions of the seismic record (which begins after the gap following the header block) begins with a unique start-of-scan and is coincident with the time break. In order to create a unique start-of-scan indication, it is necessary to have at least one forbidden data value. This requires four bytes, the first three of which are all 1's and the fourth byte is gain code. To avoid this same combination in other data, all 1's are ruled out. These four bytes plus the two bytes for each of the 30 data channels (seismic

plus auxiliary) make up the total 64 bytes per scan used in this format.

Numerical values are written with negative numbers in 1's complement. A 1 in the sign bit indicates a negative value, while a 0 indicates a positive value. The negative zero, consisting of all 1's, is converted to the positive zero, all 0's whenever it appears. The data value consisting of all 1's is thus forbidden and as mentioned above, the start-of-scan indicator is chosen to be three successive bytes of all 1's followed by a byte (the gain code byte) in which at least one 0 is guaranteed.

In the event AVC, ganged AVC, or PGC is used, the 16th or G bit is not used and, if applicable, the gain trace is digitized into auxiliary channel 27. As mentioned before, with binary gain control (BGC) the 16th bit (or G bit) is used to indicate a factor-of-two gain change (approximately 6 db) and is recorded along with the first data sample to which the new gain applies.

In order to accommodate both increases and decreases in binary gain with the one available bit, it will be assumed that increases of gain are permitted to occur only on certain scans and that decreases of gain will be permitted only on the remaining scans. An upward change in gain is never urgent, while the necessity of making a downward change may be urgent to avoid overscaling the digitizer on large amplitudes. Any of several programs could be used, and the most popular will probably be to designate every 30th scan as an increases-of-gain scan and the remaining 29 scans would then be available for decreases-of-gain as required. In order therefore to indicate whether a given scan permits only up-changes or only down-changes to occur, a 1 is inserted in the *U* bit (see Figure 2) at the beginning of those scans in which only an up-change is permitted. A zero in the same position indicates that only down-changes are permitted for that scan. The computer program must be designed to read the U bit to determine whether the presence of a G bit represents an up or down gain change for that scan.

As a redundant check, the actual variable binary gain (or exponent value) is submultiplexed into the five least significant bits of the fourth byte of the start-of-scan indicator group. Note that the actual gain is submultiplexed by recording the gain of channel 1 in data-scan 1, the gain of channel 2 in data-scan 2, etc., and that the pattern is repeated every 30 data-scans. In order to indicate the end of the gain-submultiplex cycle, submultiplex scan, all 1's are inserted in the Z bits or 5 bit gain code for the 30th data scan. All 1's (31) are forbidden as a seismic data gain code.

The format requires the usual IBM cyclic-redundancy check and longitudinal redundancy check at the end of the data block. At the end of each seismic record this is followed by an end-of-file marker which comprises a 0.6-inch or greater gap and a standard end of file mark. The format requires a gap between records which is at least 0.6 inch in length and completely free of recorded bits. After the last record of interest on any tape, the end-of-file is repeated at least once to serve as an indicator to the computer that no more information follows.

SUGGESTED CHANNEL ASSIGNMENTS	
Channel	Assignment
1-24	Seismic channels
25	Auxiliary or timing counter if used
26	Auxiliary or equipment quality-monitor if applicable
27	Gain control information if BGC amplifiers are not used
28	Up-hole or water-breaks
29	Time break (and water breaks if needed for split spread shooting)
30	Timing (100 Hz from an independent source)

If less than 24 seismic channels are used, channel 1 should be used with no serial order skips permitted. This, of course, does not preclude dead or omitted traces within a series of normally used channels.

FORMAT A–(MORE THAN 30 CHANNELS)

The above description is for a 30-channel version (24 seismic plus 6 auxiliary) of Format A. The

general philosophy may be followed, however, to expand to a larger number of channels. The expansion should be done always keeping the seismic channels at the beginning of a multiplexer scan and the auxiliaries at the end. The submultiplex gain code and the number of bytes allowed in the header to describe the fixed and early gain should be changed appropriately. Each expansion of the format would of course require a new format code and should be filed with the SEG Standards Committee.

DESCRIPTION OF FORMAT B

Figure 3 shows the detailed arrangement of the data on magnetic tape. The Format B scan will consist of three basic groups of recorded signals that shall conform to the following minimum specifications on configuration-

Sync Group: This is a 4-byte (two-word) group consisting of a data "1" as bit 7 in track no. 2 of all bytes.

All other bit positions except parity are unspecified. Auxiliary Data Group: This is a 10-byte (five-word) group following the sync group and consisting of a data "0" as bit 7 in track no. 2 of the 1st, 2nd, 4th, 6th, 8th, and 10th byte positions to prevent a sync conflict; all other bit positions are unspecified.

Seis Data Group: This is another 10-byte (five-word) group. The first two bytes of this group define the four gain codes for data of four seismic data channels recorded in the remaining four words of the group. The gain word of the group is made of four gain codes of four bits each or a full binary range, 0 through 15. Thus, the input data shall be expressed as follows:

$$e_i = K(Q_s \,.\, Q_1 \ldots Q_{14})2^{-GGGG}$$

where e_i – input voltage,

K = scale constant (preamp gain, etc.)

$Q_s \,.\, Q_1 \ldots Q_{14}$ is the quantized analog signal with the binary point to the left of the MSB (exclusive of sign). *GGGG* is the gain code expressed in a positive number from zero to 15.

Six of these groups will be required to scan the data for a 24-channel seismic system. If the seismic system is extended to record additional seismic gain-controlled channels, extensions in groups of four are most logical.

The following are recommended uses of unassigned bits in the three basic groups of Format B:

Sync Group:

Bits 0 through 5 may be used for recording waterbreak counters as indicated in Figure 3.

Bits 6 in the four sync bytes may be used for different field system extensions of the number of seismic gain-controlled channels. A possible code is indicated here:

Sync byte No.	**1**	**2**	**3**	**4**	
Bit 6 Signal	0	0	0	0	indicates no extension
	1	0	0	0	indicates 1 seis data group extension
	0	1	0	0	indicates 3 seis data group extensions
	0	0	1	0	indicates4 seis data group extensions
	0	0	0	1	indicates 6 seis data group extensions

Auxiliary Data Group:

Time Counter: (Unless otherwise designated in header block with another usage code). When a basic record time code is required, a time counter shall be recorded in the first word position of this group. This counter should be a 14-bit counter incremented at a 1 *KHz* rate. Counting will begin at the beginning of recording. The T_1 bit does not indicate sign but is considered a magnitude bit. The time break event will reset the time counter to

make it count time from the time break to an accuracy of ±0.5 ms.

Uphole/Water Depth: When uphole or water depth is required, these data will be recorded as the second word of the auxiliary data group in a fashion similar to a seismic channel (less gain code).

Time Break: When the time break is required as an analog representation, it will be recorded as the third word of the auxiliary data group similar to the uphole/water depth data. When a timing signal is required as an analog representation, it will be recorded as the fourth word of the auxiliary data group.

When any other special signal that requires no change of amplifier gain with time is to be recorded, it will be recorded as the fifth word of the auxiliary data group. Other special signals may replace previously mentioned signals in operations such as VibroSeis. For example, pilot VibroSeis signals could replace the Uphole/Time Break and/or timing word.

APPENDIX

MANUFACTURERS OF SEISMIC DIGITAL FIELD RECORDING EQUIPMENT

Code No.

01 Alpine Geophysical Associates, Inc.
65 Oak Street
Norwood, New Jersey

02 Applied Magnetics Corporation
749 Ward Drive
Santa Barbara, California 93105

03 Digital Data Systems, Inc.
7415 Hillcroft Avenue
Houston, Texas 77036

04 Dresser SIE, Inc.
Dresser Center
10201 Westheimer Road
Box *2928*
Houston, Texas 77001

05 Dyna-Tronics Mfg. Corporation
5830 Star Lane Box 22202
Houston, Texas 77027

06 Electronic Instrumentation, Inc.
601 Dooley Road
Box 34046
Dallas, Texas 75234

07 Electro-Technical Labs Division
Mandrel Industries, Inc.
A subsidiary of Ampex Corporation
6909 Southwest Freeway
Box 36306
Houston, Texas 77036

08 Fortune Electronics, Inc.
5606 Parkersburg Drive
Houston, Texas 77036

09 Geo Space Corporation
5803 Glenmont Drive
Box 36374
Houston, Texas 77036

10 Leach Corporation
405 Huntington Drive San
Marino, California

11 Metrix Instrument Co.
8200 Westglen
Box 36501Houston, Texas 77042

12 Redcor Corporation
7800 Deering Avenue
Post Office Box 1031
Canoga Park, California 91304

13 Societe D'etudes, Recherches Et
Constructions Electroniques (SERCEL)
BP-11 44 Carquesou
Nantes, France

14 Scientific Data Systems (SDS)
1649 Seventeenth Street
Santa Monica, California 90404

15 Texas Instruments, Inc.
Box 5474
Dallas, Texas 75222

NOTE: Should additional manufacturer code numbers be required, contact the SEG Standards Committee for the assignment of these numbers.

SEG Field Tape Formats Subcommittee J. R. Cooper, T. N. Crook, L. Gerdes, L. I. Shock, R. C. Weisinger

RECOMMENDATIONS OF THE EXCHANGE TAPE FORMAT SUBCOMMITTEE

INTRODUCTION

During the last five years the exploration segment of the petroleum industry has begun a conversion to recording and processing seismic data digitally. In the summer of 1966, the SEG set up a Digital Recording Standards Committee to study the problems for oil companies, contractors, and vendors created by a multiplicity of digital recording tape formats and to investigate the possibility of finding a format or formats acceptable to the industry as a whole. At a second meeting of this committee, a subcommittee was appointed to study and recommend a file or exchange tape format. The recommendations of that subcommittee are included in this report.

Shortly after the formation of this subcommittee, an "Exchange Tape Questionnaire" was sent to members of the geophysical industry to determine specific trends, requirements, and preferences in regard to the storage, transfer, and exchange of seismic data. On the basis of the replies to this questionnaire, this subcommittee set about the task of developing a generalized tape format suitable for filing and exchanging raw seismic field data.

In order that a file or exchange tape format be acceptable to a wide spectrum of users, it must be flexible, adaptable, comprehensive, and efficient (especially in regard to processing). The design philosophy of the proposed format includes all of these requirements plus the requirement that the format be capable of completely representing the original field data but allow for mechanical editing and demultiplexing. Provisions were made to incorporate any number of records, any number of data and information channels, all gain control systems, any length of trace, etc.; and the data and identification are variable-length records to facilitate the use of the format as an "in-house" storage and processing format if desired.

FORMAT

The format recommended for exchanging seismic data is logically divided into three sections: Header Identification, Seismic Data, and Trailer, as shown in Figure 4.

Header Identification file

The Header Identification describes the data from a line of shotpoints in a variable number of card images in narrative form. In other words, the Header does not consist of data in specific card columns in a rigid format, but the committee recommends that each card image of the Header file should contain the character C in the first card column. For example, a printout of the first card image might be as follows:

C THIS IS LINE 537A OF THE NORTH SEA PROSPECT

The Header section would thus consist of a series of short (80-character or byte) records separated by inter-record gaps (see Figure 4). On 7-track tape, this section would be written in BCD character code; on 9-track tape the Header would be written in EBCDIC character code. In any event, each such record would yield one line of print.

The data in this section could thus be printed and edited prior to the actual input of seismic data for processing. A listing of the Header would normally accompany a transfer tape and serve as a table of contents and summary of specifications for that line of seismic data. If two or more lines of seismic data are written on the same reel, each would have a unique Header file which would precede the data of the line described. An end-of-file tape mark follows the Header and separates it from the seismic data section.

The recommended contents of the Header Identification File are as follows:

A. Identification
   Company or combine name
   Line number
   Map number or quad name
   Reel number of this set of data

B. Data type
   Type of seismic source
   Fold

Original data equivalent
State of processing

C. Hardware recording parameters
Equipment manufacturer, model number, and identification
Sample rate of data
Gain mode and rate of change restrictions
Recording and aliasing filters Recording cable parameters
Specifications for the determination of time break and water-break times

D. Field recording parameters
Distances measured in feet or meters
Shothole spacing and configuration
Group spacing
Number of groups
Number of seismometers per group
Seismometer spacing and configuration
Type, frequency, hookup, and damping of seismometers

E. Data format
Number of seismic records
Number of traces per record
Number of data samples per trace
Tape format: number of tracks and packing density
Number of bytes (characters) of identification per trace (16-100)
Number of bytes (characters) of gain information per trace (0-200)
Number of bytes (characters) per amplitude sample
Negative number system (one's complement or two's complement)
Number of traces per binary gain control unit
Number of contributors per inverse gain or amplitude trace
Location and number of water-break detectors

F. Other comments
Date of start of line

Seismic data

The seismic data should be written in a demultiplexed format with the trace identification, the gain data, and the numerical values for each trace contained in a single physical magnetic tape record (see Figure 4). The traces are separated by inter-record gaps, and, if desired, groups of traces from the same seismic record may be separated from other groups by end-of-file marks. Two end-of-file marks follow the last data record for a line and precede the next Header (if more than one seismic line is written on a reel) or the Trailer for the reel. Auxiliary traces will precede seismic data traces and will receive artificial hexidecimal trace numbers. The artificial trace numbers are assigned as follows-

1,000	gain recovery trace
2,000	time break trace
3,000	Uphole trace
4,000	VibroSeis pilot signal
5,000	VibroSeis monitor
6,000	water-break traces
• • •	
9,000	

Auxiliary traces will be present only if they apply; for example, a time break trace will not be present if the time break determination is as simple as the change in value of a particular bit. The gain recovery trace will be the actual trace recorded in the field or computed from instrument settings if the data were recorded with analog equipment. This trace record is obviously dependent upon the field equipment taking the data.

Each seismic trace will have between sixteen and one hundred bytes of identification information which precedes the binary gain data and the actual seismic trace. The data to be included and a recommended sequence are as follows:

Data	**No. of Bytes Required**
Sequence number	(4)
Trace number	(4)
Shotpoint or recorded number	(4)
Dead trace flag (0 if dead, 1 if good)	(4)

Group elevation	(4)
Shotpoint-to-group distance	(4)
Coded shot type and charge size	(4)
Shot depth and elevation of shotpoint	(4)
Location of shotpoint	(8)

All additional items must be specified in the Header Identification File under "Comments." The number of bytes or characters for each item above should be specified in the Header Area.

Binary gain data will be stored compactly in about 200 bytes (characters) prior to the data values for each seismic trace. The actual number of bytes or characters used should be indicated in the Header Identification Area. The gain indicated will apply for the indicated sample number and all subsequent samples until a new gain value and sample number is entered. Thus a gain data length of 200 bytes would allow for recording the sample number and gain value for 50 gain changes.

The magnitude of the sample value will be expressed as two bytes (15 bits plus sign) in the 9-track format and in two or more characters for the 7-track format. Negative numbers should be expressed in one's or two's complement.

Trailer

The Trailer section consists of a variable number of card images with either a T (for trailer) or E (for end-of-job) in the first column. The symbol T will be used if additional seismic data for the line are on another reel. The information that should be included in this section consists of the number of complete seismic records that have been written, the number of traces from the current record that were written, and, if available, the reel number or identification tag for the tape on which the continuation of this data may be found. The symbol E will indicate the end-of-job, and then this section should summarize the data that have been written indicating the number of records and traces written, etc. The Trailer thus serves to alert the operator that a new reel must be mounted and that the present reel may be rewound.

GENERAL EXCHANCE TAPE SPECIFICATIONS

The following is a list of general recommendations for the exchange tape:

1. The magnetic tape used should be computer grade; pre-tested at 800 BPI and 1.5 mil Mylar base; the hub size should be IBM compatible.
2. Tape specifications, track spacing, longitudinal parity, cyclic redundancy checks, gaps, etc., are to be compatible with IBM specifications.
3. Non-Return-to-Zero (NRZ) mode should be used to write the data onto tape.
4. Packing density should be 800 bpi for nine-track tape and 556 or 800 characters per inch for seven-track tape.
5. Data values are to be written in binary mode with odd vertical parity. On nine-track tape two bytes will be used to represent each data value; on seven-track tape there should be two or three characters per data value.
6. Negative numbers should be represented in either one's complement or in two's complement.
7. The Header and Trailer data should be represented in BCD (Binary Coded Decimal) character code on seven-track tape and in EBCDIC (Extended Binary Coded Decimal Interchange Code) character code if it is on nine-track tape.

CONCLUSIONS

Though each individual company and contractor may be convinced his own format is best, unless some level of industry standardization of the exchange tape is achieved, every company will need a multitude of input and output programs to process data acquired by trading, acquisitions, mergers, and joint exploration ventures. Substantial sums of money, computer time, and programming effort can be saved if the

geophysical industry will adopt a standard format for the interchange of seismic data as well as for the recording and filing of seismic data. Such standardization will save not only the initial costs of producing and checking numerous input and output programs, but also the costs of maintaining and updating these programs.

SEG Exchange Tape Format Subcommittee James J. Bradley George F. Cook Sheldon E. Elliott Tom K. Fulton Robert B. Kerr Carl H. Savit.

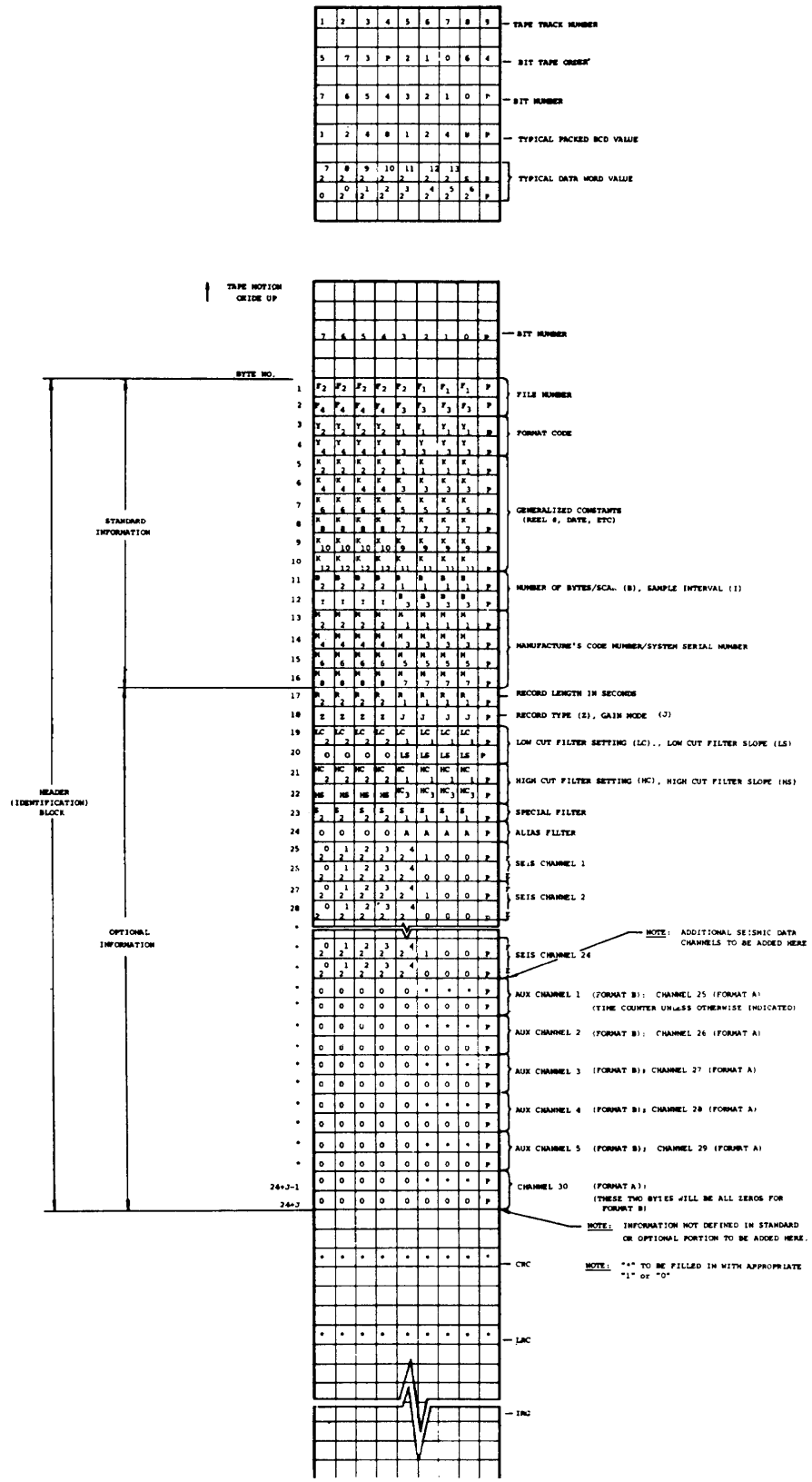

FIG. 1 Header Block

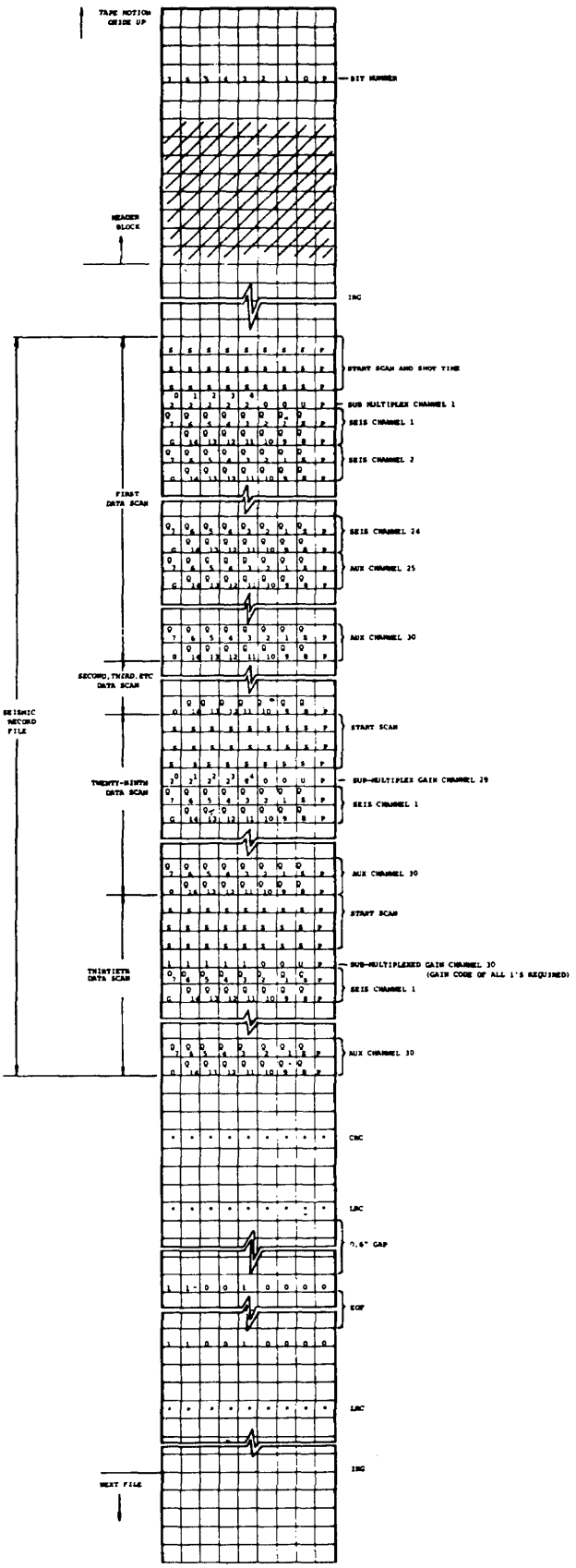

FIG. 2. Format A.

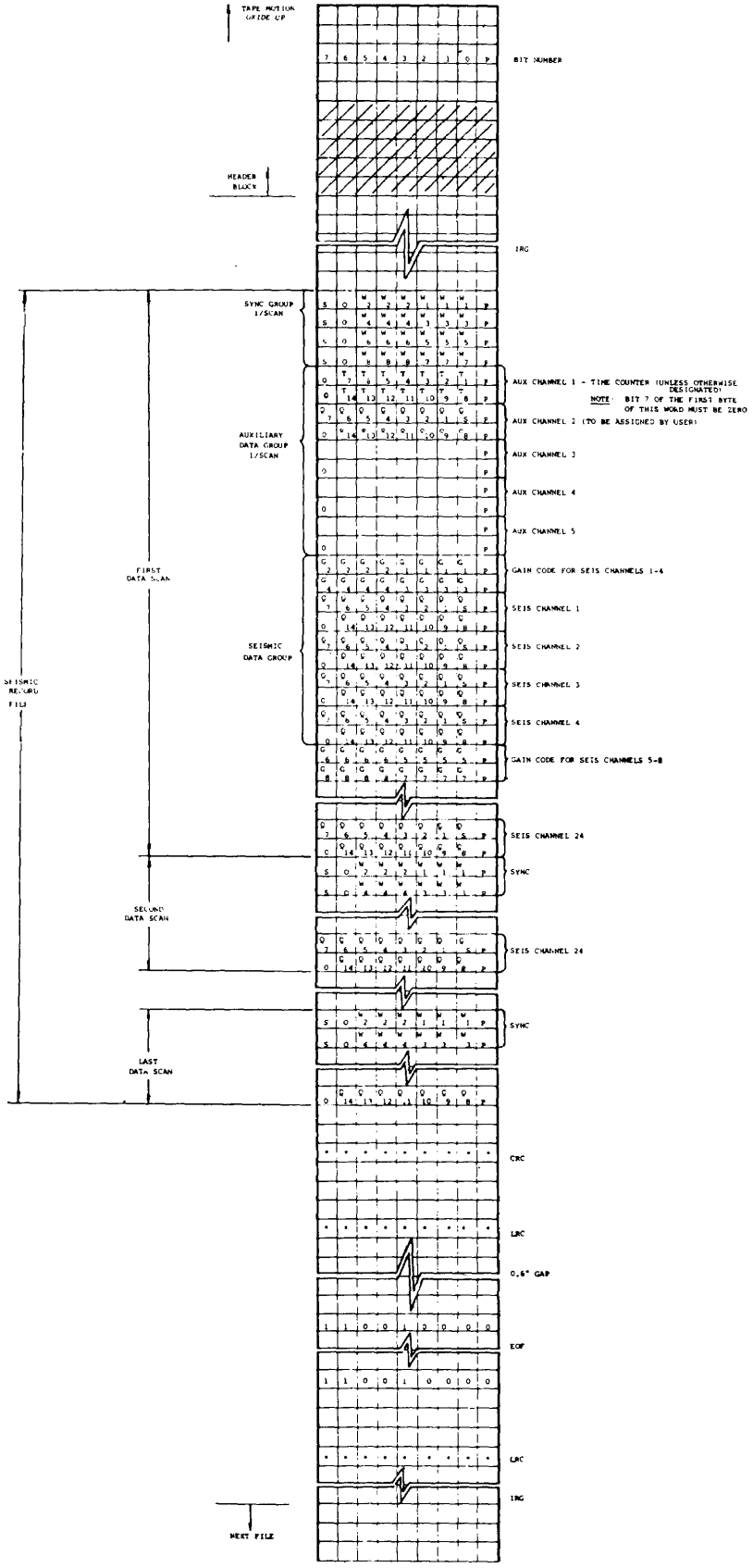

FIG. 3.Format B.

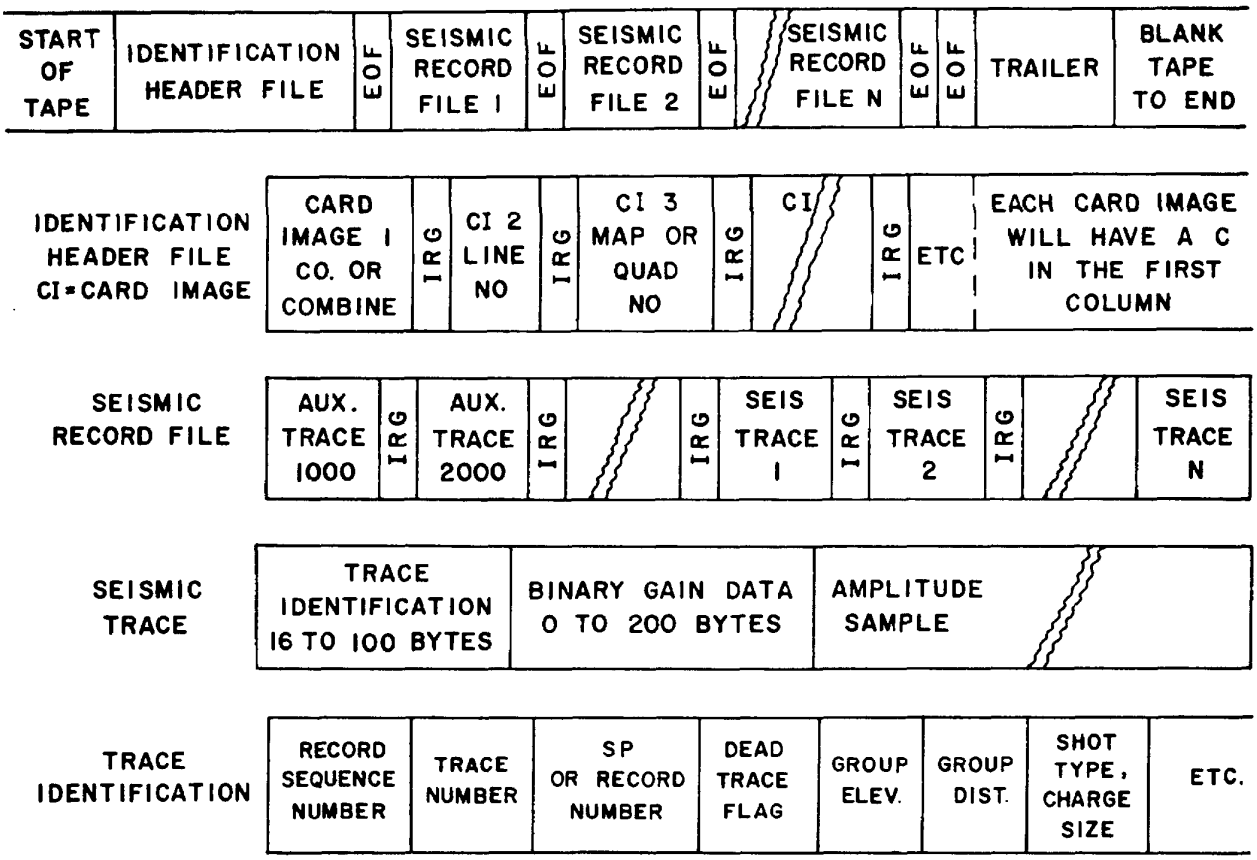

FIG. 4. Proposed standard exchange tape format.