

LAS Version 2.0: A Digital Standard for Logs, Update February 2017

BY

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1.0 Abstract:

The LAS 2.0 log data standard was introduced in 1992 and continues to be popular. This paper updates the LAS 2.0 documentation and makes minor changes to the LAS 2.0 specifications to better reflect the technological advances made since its introduction.

The changes and clarifications are as follows:

- Line length is unrestricted in unwrapped mode (change)
- The depth value divided by the step value must be a whole number (clarification)
- Rounding of depth values is not acceptable. (clarification)
- The delimiters in a non-comment line are the first dot in the line, the first space after that dot and the last colon in the line. (clarification)
- The index curve (i.e. first curve) must be depth, time or index. The only valid mnemonics for the index channel are DEPT, DEPTH, TIME, or INDEX. (change)
- Time and date can be included in LAS 2.0 files provided that they are expressed as a number. The ISO 8601 standard for date and time provides such an option. See section 5.9 for more information.

2.0 Introduction:

This paper updates the LAS 2.0 documentation (Log ASCII Standard version 2.0). The updating was necessary to clarify some items not specifically stated in the earlier documentation and to better reflect the technological advances made since its introduction.

The LAS standard was introduced by the Canadian Well Logging Society in 1989 to standardize the organization of digital log curve information for use on personal computers. It did this very successfully and the standard became popular worldwide. Version 1.2 was the first version and was followed in September 1992 by LAS version 2.0 to address some inconsistencies. The LAS 2.0 version is viewed as a log data exchange format and remains the dominant product.

In 1999, the LAS 3.0 version was introduced to provide expanded data storage capabilities that include not only log curve data, but also core, inclinometry, drilling, formation tops and test data. LAS 3.0 is viewed as a wellbore data storage format and continues to see limited implementation.

3.0 LAS 2.0 Overview:

- An LAS file is a structured ASCII file containing log curve data and header information. The header information is located at the beginning of the file and followed by curve data.
- The standard was designed to simplify the exchange of digital log data between users.
- The LAS format is intended for optically presented log curves, although other curves may also be included.
- The ASCII character set is limited to ASCII 13 (carriage return), ASCII 10 (line feed), and ASCII 32 to ASCII 126 inclusive. All other ASCII characters are not allowed and it is suggested that software readers convert them to a space (removing them may cause issues if the character was intended to represent a space such as the tab character). Line termination will consist of ASCII 13 ASCII 10 (CR LF) except for the last line.
- Each LAS 2.0 file contains only one continuous interval in the data section. For example, a repeat section would make up one LAS file and the main pass another.
- LAS files end in ".LAS" so that they can be easily recognized.
- Each LAS file consists of sections. Sections begin with a header line defined as beginning with the ~ tilde character when it occurs as the first non-space character on a line. The character immediately following the tilde character defines the section, with the remainder of the line being ignored. The characters "V", "W", "C", "P", "O", and "A" are reserved in the LAS 2.0 standard. The sections defined by the LAS 2.0 standard are limited to one occurrence per file. Customer defined sections are permitted but must be located after the first section (~V) and before the last section (~A).
 - The sections defined for the LAS 2.0 standard are as follows:
 - "~V" (also known as "~VERSION INFORMATION SECTION") is a required section; has formatting requirements; must be the first section; identifies the version number and whether data is in "wrapped" or "un-wrapped" mode.
 - "~W" (also known as "WELL INFORMATION SECTION") is a required section; has formatting requirements; is preferably the second section; contains information on the well name, location, and start and stop values of the data in this file.
 - "~C" (also known as ~CURVE INFORMATION SECTION") is a required section; has formatting requirements; contains curve mnemonics and their definitions in the order that they appear in the data section.
 - "~P" (also known as ~PARAMETER INFORMATION SECTION") is an optional section; has formatting requirements; contains information on parameters or constants relevant to the wellbore such as mud resistivity, wireline engineer, truck number etc.
 - "~O" (also known as "~OTHER") is an optional section; has no formatting requirements; contains other information or comments.
 - "~A" (also known as ~ASCII LOG DATA") is a required section; has formatting requirements; is the last section in the file and is also referred to as the data section. The index of the data columns is either depth, time, or index. The index values always appear in the first column and each column of data must be separated by at least one space (ASCII 32). All values in the ASCII log data section must be floating point or integer (long) values. Other formats such as Text or Exponential values are not supported.
- Two flags are used in LAS files: 1) "#" signifies a comment line when used as the first non-space character on a line and 2) "~" signifies the beginning of a section when used as the first non-space character on a line.
- The sections "VERSION", "WELL", "CURVE" and "PARAMETER" use line delimiters. The delimiters are: 1) first dot in a line 2) first space after the first dot in a line and 3) the last colon in a line.

- Example LAS files can be found at the end of this paper.

4.0 Software:

Software exists to assist LAS data users and can be found on the CWLS website (www.cwls.org). The LAS Applications (LasApps) software will check all versions of LAS files for errors and provide routines to fix most of the common errors encountered.

The utility includes the following processes:

- 1) Check LAS files for errors (also known as Certify routine)
- 2) Scan and fix most of the common errors encountered in LAS files
- 3) Convert LAS 1.2 to 2.0 and LAS 3.0 to LAS 2.0
- 4) Fix depth step related issues
- 5) Resample data
- 6) Reverse depth direction
- 7) Wrap and unwrap LAS files
- 8) Change depth from metres to feet or feet to metres
- 9) Change curve mnemonics
- 10) Convert text files to LAS files
- 11) Merge LAS files
- 12) Modify LAS headings

The above programs are not part of the LAS standard. The author of this program does not reserve any rights and does not warrant the program for any specific purpose.

5.0 Details:

This portion of the paper provides a detailed look at all of the components of an LAS 2.0 file. Flags and delimiters are discussed first, followed by a discussion of the 'sections' as defined by the LAS 2.0 format. This portion of the paper is best understood by looking at the examples in the boxed areas and the examples provided at the end of this paper.

5.1 Flags

Certain characters are used to assist software in identifying specific lines within a file. The following flags are defined in the LAS 2.0 format:

"~" (tilde): The ASCII equivalent of this flag is decimal 126. This character is recognized as a flag when it occurs as the first non-space character on a line. This flag is used to mark the beginning of a section within an LAS file. The first letter directly after the tilde identifies the section. The upper case letters "V", "W", "P", "C", "O", and "A" in the space following a tilde mark are reserved for use by the committee. The remainder of the line will be treated as comments.

"#" (pound): The ASCII equivalent of this flag is decimal 35. This character is recognized as a flag when it occurs as the first non-space character on a line. This flag is used to indicate that the line is a comment line. Comment lines can appear anywhere above the ~A section.

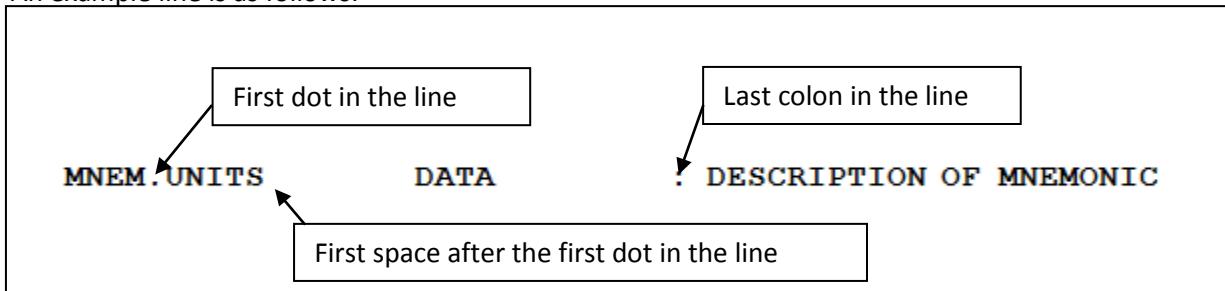
5.2 Line Delimiters

Three line delimiters are used in the "~V", "~W", "~C", and "~P" sections of LAS files. The line delimiters are as follows:

- a) the first dot in a line,
- b) the first space after the first dot in a line
- c) the last colon in a line

All non-comment lines in these sections must contain all three of the above delimiters.

An example line is as follows:



Where:

MNEM = mnemonic. This mnemonic can be of any length but must not contain any internal spaces, dots, or colons. Spaces are permitted in front of the mnemonic and between the end of the mnemonic and the dot.

UNITS = units of the mnemonic (if applicable). The units, if used, must be located directly after the dot. There must be no spaces between the units and the dot. The units can be of any length but must not contain any colons or internal spaces.

DATA = value of, or data relating to the mnemonic. This value or input can be of any length and can contain spaces, dots or colons as appropriate. It must be preceded by at least one space to demarcate it from the units and must be to the left of the last colon in the line.

DESCRIPTION = description or definition of the mnemonic. It is always located to the right of the last colon. The length of the line is no longer limited.

5.3 ~V (Version Information)

- This section is mandatory and must appear as the first section in the file.
- Only one "~~V" section can occur in an LAS 2.0 file.
- It identifies the version of the LAS format and whether wrap mode is used.
- This section must contain the following lines:

VERS. 2.0 : CWLS LOG ASCII STANDARD - VERSION 2.0

Refers to which version of LAS used.

and

WRAP. YES : Multiple lines per depth step

or

WRAP. NO : One line per depth step

Refers to whether a wrap around mode was used in the data section. If the wrap mode is "NO", there is no limit to the line length. If wrap mode is used, the depth value will be on its own line and all lines of data will be no longer than 80 characters (including carriage return and line feed).

- There is no longer a line length limited on LAS files. The original LAS format was limited to a line length of 256 characters because of early computer limitations. Modern computer equipment does not have an issue with line lengths and therefore the line length limitation has been withdrawn. The updated LAS 2.0 standard retains the "WRAP YES" definition as an option and for backwards compatibility.
- Additional lines in the version section are optional.
- The following is an example of a Version Information Section.

~Version Information Section

VERS.	2.0	:	CWLS log ASCII Standard -VERSION 2.0
WRAP.	NO	:	One line per depth step

5.4 ~W (Well Information)

- This section is mandatory.
- Only one "~~W" section can occur in an LAS 2.0 file.
- It identifies the well, its unique location identifier and indicates the start and stop depths (or time, or index number) of the file.
- This section must contain the following lines with the mnemonics as indicated:

STRT.M nnn.nn : START DEPTH

Refers to the first depth (or time, or index number) in the file. The "nnn.nn" refers to the depth (or time or index) value. The value must be identical in value to the first depth (time, index) in the ~ASCII section although its format may vary (123.45 is equivalent to 123.45000).

The number of decimals used is not restricted. If the index is depth, the units must be M (metres), F (feet) or FT (feet). Units must match on the lines relating to STRT, STOP, STEP and the index (first) channel in the ~C section. If time or index the units can be any unit that results in a floating point number representation of time or the index number. (dd/mm/yy or hh:mm:ss formats are not supported). The logical depth, time or index order can be

increasing or decreasing. The start depth (or time, or index) value when divided by the step depth (or time or index) value must be a whole number.

STOP.M **nnn.n** : STOP DEPTH

Same comments as for STRT except this value represents the LAST data line in the ~ASCII log data section. The stop depth (or time or index) value when divided by the step depth (or time or index) value must be a whole number.

STEP.M **nnn.nn** : STEP

Same comments as for STRT, except this value represents the actual difference between every successive depth, time or index values in the ~ASCII log data section. The sign (+ or -) represents the logical difference between each successive index value. (+ for increasing index values). The step must be identical in value between every index value throughout the file. If the step increment is not exactly consistent between every depth, time or index sample, then the step must have a value of 0.

NULL. **nnnn.nn** : NULL VALUE

Refers to null values. Commonly used null values are -9999, -999.25 and -9999.25.

COMP. **aaaaaaaaaaaaaaaaaaaaaa** : COMPANY

Refers to company name.

WELL. **aaaaaaaaaaaaaaaaaaaaaa** : WELL

Refers to the well name.

FLD. **aaaaaaaaaaaaaaaaaaaaaa** : FIELD

Refers to the field name.

LOC. **aaaaaaaaaaaaaaaaaaaaaa** : LOCATION

Refers to the well location.

PROV. **aaaaaaaaaaaaaaaaaaaaaa** : PROVINCE

Refers to the province. For areas outside Canada this line may be replaced by:

CNTY. **aaaaaaaaaaaaaaaaaaaaaa** : COUNTY

STAT. **aaaaaaaaaaaaaaaaaaaaaa** : STATE

CTRY. **aaaaaaaaaaaaaaaaaaaaaa** : COUNTRY

SRVC. **aaaaaaaaaaaaaaaaaaaaaa** : SERVICE COMPANY

Refers to logging/service company.

DATE. **aaaaaaaaaaaaaaaaaaaaaa** : DATE

Refers to date logged. The preferred date is of the form yyyy-mm-dd

UWI . **aaaaaaaaaaaaaaaaaaaaaa** : UNIQUE WELL ID

Refers to unique well identifier. Within Canada, the most common UWI consists of a 16 character string. Excluding all dashes, slashes and spaces from such UWIs makes it easier for software to parse them.

For areas in the United States this may be replaced by:

API . aaaaaaaaaaaaaaaaaaaaaa : API NUMBER

- Additional lines in the well information section are optional. There is no limit on the number of additional lines.

LIC. nnnnnn : LICENCE NUMBER

Refers to a regulatory licence number. Required by ERCB in Alberta

- The following is an example of a Well Information Section in LAS version 2.0:

~Well Information Section		
#MNEM.UNIT	VALUE/NAME	DESCRIPTION
STRT.M	635.0000	:START DEPTH
STOP.M	400.0000	:STOP DEPTH
STEP.M	-0.125	:STEP
NULL.	-999.25	:NULL VALUE
COMP.	ANY OIL COMPANY INC.	:COMPANY
WELL.	ANY ET AL 12-34-12-34	:WELL
FLD .	WILDCAT	:FIELD
LOC .	12-34-12-34W5M	:LOCATION
PROV.	ALBERTA	:PROVINCE
SRVC.	ANY LOGGING COMPANY INC.	:SERVICE COMPANY
LIC .	12345	:ERCB LICENCE NUMBER
DATE.	13-DEC-86	:LOG DATE
UWI .	100123401234W500	:UNIQUE WELL ID

5.5 ~C (Curve Information)

- This section is mandatory.
- Only one "~C" section can occur in an LAS 2.0 file.
- It describes the curves and its units in the order they appear in the ~ASCII log data section of the file.
- The mnemonics used are not restricted but must be defined on the line in which they appear.
- API curve codes are optional. (May be required by some regulatory agencies)
- The channels described in this section must be present in the data set.
- The first channel described is the index of all other channels, and must be depth, time, or index. The only valid mnemonics for the index channel are DEPT, DEPTH, TIME or INDEX.

The following is an example of a Curve Information Section with API codes.

~Curve Information Section			
#MNEM.UNIT	API CODE	Curve Description	
DEPT .M		:	1 DEPTH
RHOB .K/M3	45 350 02 00	:	2 BULK DENSITY
NPH .VOL/VO	42 890 00 00	:	3 NEUTRON POROSITY - SANDSTONE
MSFL .OHMM	20 270 01 00	:	4 Rxo RESISTIVITY
SFLA .OHMM	07 222 01 00	:	5 SHALLOW RESISTIVITY
ILM .OHMM	07 120 44 00	:	6 MEDIUM RESISTIVITY
ILD .OHMM	07 120 46 00	:	7 DEEP RESISTIVITY
SP .MV	07 010 01 00	:	8 SPONTANEOUS POTENTIAL
GR .GAPI	45 310 01 00	:	9 GAMMA RAY
CALI .MM	45 280 01 00	:	10 CALIPER

5.6 ~P (Parameter Information)

- This section is optional. It defines the input values of various parameters relating to this well. These input values can consist of numbers or text.
- Only one "~~P" section can occur in an LAS 2.0 file.
- The mnemonics used are not restricted but must be defined on the line on which they appear.
- There is no limit on the number of lines that can be used.
- The following is an example of a Parameter Information Section.

~Parameter Information Section			
#MNEM.UNIT	Value	Description	
MUD .	GEL CHEM	:	Mud type
BHT .DEGC	114.0000	:	Bottom Hole Temperature
BS .MM	222.0000	:	Bit Size
CSGL .M	345.7	:	Casing Depth
FD .K/M3	999.9999	:	Fluid Density
MDEN .K/M3	2650.0000	:	Logging Matrix Density
MATR .	SAND	:	Neutron Matrix
FNUM .	1.0000	:	Tortuosity Const. Archie's(a)
FEXP .	2.000	:	Cementation Exp Archie's (m)
DFD .K/M3	1200.0000	:	Mud Weight
DFV .S	50.0000	:	Mud Viscosity
DFL .C3	8.0000	:	Mud Fluid Loss
DFPH .	10.00	:	Mud pH
RMFS .OHMM	2.8200	:	Mud Filtrate Resistivity
EKB .M	566.9700	:	Elevation Kelly Bushing
EGL .M	563.6799	:	Elevation Ground Level

5.7 ~O (Other Information)

- This section is optional. It is intended as a remarks or comments section.
- Only one "~~O" section can occur in an LAS 2.0 file.
- This section has no delimiter requirements.
- The following is an example of an "Other Information Section"

```
-----  
~Other Information Section  
The log digits for this well were hand digitized from poor half scale  
log prints. This was the best information available at the time.  
Every attempt should be made to track down the original films.  
.Dec. 12,1990 John Doe, Petrophysics
```

5.8 ~A (ASCII Log Data)

- The data section will always be the last section in a file.
- Only one "~~A" section can occur in an LAS 2.0 file.
- Embedded blank lines anywhere in the section are forbidden
- Each column of data must be separated by at least one space. Consistency of format on every line, while not required, is expected by many LAS readers. Right Justification of each column of data and the same width of all data fields is highly recommended.
- Line length in the data section of unwrapped files are no longer restricted
- In wrap mode, the index channel will be on its own line
- In wrap mode, a line of data will be no longer than 80 characters. This includes a carriage return and line feed.

5.9 Date and Time Curves in the Data (~A) section

Date and time can be included as a curve in the data section of LAS 2.0 files if they are expressed as a number. The ISO 8601 standard for date and time includes such an option.

The date in ISO 8601 standard is expressed as YYYY-MM-DD or as YYYYMMDD where:

YYYY = four digit year

MM = zero padded two digit month of the year from 00 through 12.

DD = zero padded two digit day of that month from 00 through 31.

The LAS 2.0 standard will accept YYYYMMDD for the date but will NOT accept YYYY-MM-DD

The date in the ISO 8601 standard can also be expressed as ordinal dates in the form of YYYY-DDD or YYYYDDD where:

YYYY = four digit year

DDD = the zero padded day of that year, from 001 through 365 (366 in leap years)

The LAS 2.0 standard will accept YYYYDDD for the ordinal date.

Times in the ISO 8601 standard is expressed as:

hh:mm:ss.ss or hhmmss.ss

hh:mm:ss or hhmmss

hh:mm or hhmm

hh

Where:

hh = zero padded hour between 00 and 24 (where 24 is only used to denote midnight at the end of the calendar day).

mm = zero padded minute between 00 and 59

ss = zero padded second between 00 and 60 (60 is only used to denote an added leap second)

The LAS 2.0 standard will accept hhmmss.ss or hhmmss or hhmm or hh for time.

Example #5 is an LAS file with time and date data presented in various forms.

6.0 References

C. Struyk, R. Bishop, D. Fortune, E. Foster, D. Gordon, T. d'Haene, D. Joyce, S. Kenny, H. Kowalchuk and M. Stadnyk, 1989; LAS, A Floppy Disk Standard For Log Data, Canadian Well Logging Society, 12th Formation Evaluation Symposium , Paper J ; The Log Analyst, V30, No.5 P 395-396; Geobyte 1989.

CWLS Floppy Disk Committee; 1992; LAS 2.0, A Floppy Disk Standard For Log Data.

CWLS LAS Committee; 2009, LAS Version 2.0 Updated: July 2009, A digital Standard for Logs.

CWLS LAS Committee; 2014, LAS Version 2.0: A digital Standard for Logs, Update January 2014.

ISO 8601, https://en.wikipedia.org/wiki/ISO_8601

Example #1 - LAS 2.0 in Unwrapped Mode

~VERSION INFORMATION

VERS. 2.0 : CWLS LOG ASCII STANDARD -VERSION 2.0
WRAP. NO : ONE LINE PER DEPTH STEP

~WELL INFORMATION

#MNEM.UNIT	DATA	DESCRIPTION
STRT .M	1670.0000	:START DEPTH
STOP .M	1669.7500	:STOP DEPTH
STEP .M	-0.1250	:STEP
NULL .	-999.25	:NULL VALUE
COMP .	ANY OIL COMPANY INC.	:COMPANY
WELL .	ANY ET AL 12-34-12-34	:WELL
FLD .	WILDCAT	:FIELD
LOC .	12-34-12-34W5M	:LOCATION
PROV .	ALBERTA	:PROVINCE
SRVC .	ANY LOGGING COMPANY INC.	:SERVICE COMPANY
DATE .	13-DEC-86	:LOG DATE
UWI .	100123401234W500	:UNIQUE WELL ID
LIC .	23412	:ERCB LICENCE NUMB

~CURVE INFORMATION

#MNEM.UNIT	API CODES	CURVE DESCRIPTION
DEPT .M		: 1 DEPTH
DT .US/M	60 520 32 00	: 2 SONIC TRANSIT TIME
RHOB .K/M3	45 350 01 00	: 3 BULK DENSITY
NPHI .V/V	42 890 00 00	: 4 NEUTRON POROSITY
SFLU .OHMM	07 220 04 00	: 5 SHALLOW RESISTIVITY
SFLA .OHMM	07 222 01 00	: 6 SHALLOW RESISTIVITY
ILM .OHMM	07 120 44 00	: 7 MEDIUM RESISTIVITY
ILD .OHMM	07 120 46 00	: 8 DEEP RESISTIVITY

~PARAMETER INFORMATION

#MNEM.UNIT	VALUE	DESCRIPTION
MUD .	GEL CHEM	: MUD TYPE
BHT .DEGC	35.5000	: BOTTOM HOLE TEMPERATURE
CSGL .M	124.6	: BASE OF CASING
MATR .	SAND	: NEUTRON MATRIX
MDEN .	2710.0000	: LOGGING MATRIX DENSITY
RMF .OHMM	0.2160	: MUD FILTRATE RESISTIVITY
DFD .K/M3	1525.0000	: DRILL FLUID DENSITY

~OTHER

Note: The logging tools became stuck at 625 metres causing the data between 625 metres and 615 metres to be invalid.

#

~A	DEPTH	DT	RHOB	NPHI	SFLU	SFLA	ILM	ILD
1670.000	123.450	2550.000	0.450	123.450	123.450	110.200	05.600	
1669.875	123.450	2550.000	0.450	123.450	123.450	110.200	05.600	
1669.750	123.450	2550.000	0.450	123.450	123.450	110.200	105.600	

Example #2 - LAS 2.0 With Minimal Header Information in Unwrapped Mode.

```
~V
VERS.          2.0   :  CWLS LAS-VERSION 2.0
WRAP.          NO    :  One line per depth step
~W
STRT.M         635.0000   : START DEPTH
STOP.M         634.8750   : STOP DEPTH
STEP.M         -0.1250   : STEP
NULL.          -999.25   : NULL VALUE
COMP.          ANY OIL COMPANY INC.      : COMPANY
WELL.          ANY ET AL 12-34-12-34   : WELL
FLD .          WILDCAT           : FIELD
LOC .          12-34-12-34W5M        : LOCATION
PROV.          ALBERTA           : PROVINCE
SRVC.          ANY LOGGING COMPANY INC.  : SERVICE COMPANY
DATE.          13-DEC-86           : LOG DATE
UWI .          100123401234W500      : UNIQUE WELL ID
LIC .          23412             : ERCB LICENCE NUMB
~C
DEPT  .M       : DEPTH
RHOB .K/M3     : BULK DENSITY
NPHI .VOL/VOL  : NEUTRON POROSITY - SANDSTONE
MSFL .OHMM    : RXO RESISTIVITY
SFLA .OHMM    : SHALLOW RESISTIVITY
ILM  .OHMM    : MEDIUM RESISTIVITY
ILD  .OHMM    : DEEP RESISTIVITY
SP   .MV       : SPONTANEOUS POTENTIAL
~A
635.0000  2256.0000  0.4033  22.0781 22.0781 20.3438 3.6660 123.4
634.8750  2256.0000  0.4033  22.0781 22.0781 20.3438 3.6660 123.4
```

Example #3 – LAS 2.0 Wrapped Version

```

~VERSION INFORMATION
VERS.          2.0      :  CWLS log ASCII Standard -VERSION 2.0
WRAP.         YES      :  Multiple lines per depth step

~WELL INFORMATION
#MNEM.UNIT          DATA          DESCRIPTION
#-----          -----          -----
STRT  .M          910.0000      :START DEPTH
STOP  .M          909.5000      :STOP DEPTH
STEP  .M          -0.1250      :STEP
NULL  .           -999.25      :NULL VALUE
COMP  .           ANY OIL COMPANY INC. :COMPANY
WELL  .           ANY ET AL 12-34-12-34 :WELL
FLD   .           WILDCAT      :FIELD
LOC   .           12-34-12-34W5M :LOCATION
PROV  .           ALBERTA      :PROVINCE
SRVC  .           ANY LOGGING COMPANY INC. :SERVICE COMPANY
SON   .           142085       :SERVICE ORDER NUMBER
DATE  .           13-DEC-86      :LOG DATE
UWI   .           100123401234W500 :UNIQUE WELL ID
LIC   .           23412        :LICENCE NUMB.

~CURVE INFORMATION
#MNEM.UNIT          Curve Description
#-----          -----
DEPT  .M          : Depth
DT    .US/M        : 1 Sonic Travel Time
RHOB  .K/M         : 2 Density-Bulk Density
NPHI  .V/V         : 3 Porosity -Neutron
RXO   .OHMM        : 4 Resistivity -Rxo
RESS  .OHMM        : 5 Resistivity -Shallow
RESM  .OHMM        : 6 Resistivity -Medium
RESD  .OHMM        : 7 Resistivity -Deep
SP    .MV          : 8 Spon. Potential
GR    .GAPI        : 9 Gamma Ray
CALI  .MM          : 10 Caliper
DRHO  .K/M3        : 11 Delta-Rho
EATT  .DBM         : 12 EPT Attenuation
TPL   .NS/M        : 13 TP -EPT
PEF   .           : 14 PhotoElectric Factor
FFI   .V/V         : 15 Porosity -NML FFI
DCAL  .MM          : 16 Caliper-Differential
RHGF  .K/M3        : 17 Density-Formation
RHGA  .K/M3        : 18 Density-Apparent
SPBL  .MV          : 19 Baseline SP
GRC   .GAPI        : 20 Gamma Ray BHC
PHIA  .V/V         : 21 Porosity -Apparent
PHID  .V/V         : 22 Porosity -Density
PHIE  .V/V         : 23 Porosity -Effective
PHIN  .V/V         : 24 Porosity -Neut BHC

```

PHIC	.V/V	: 25 Porosity -Total HCC
RO	.OHMM	: 26 Ro
RWA	.OHMM	: 27 Rfa
SW	.	: 28 Sw -Effective
MSI	.	: 29 Sh Iidx -Min
BVW	.	: 30 BVW
FGAS	.	: 31 Flag -Gas Index
PIDX	.	: 32 Prod Iidx
FBH	.	: 33 Flag -Bad Hole
FHCC	.	: 34 Flag -HC Correction
LSWB	.	: 35 Flag -Limit SWB

~A Log data section

910.000000

-999.2500	2692.7075	0.3140	19.4086	19.4086	13.1709	12.2681
-1.5010	96.5306	204.7177	30.5822	-999.2500	-999.2500	3.2515
-999.2500	4.7177	3025.0264	3025.0264	-1.5010	93.1378	0.1641
0.0101	0.1641	0.3140	0.1641	11.1397	0.3304	0.9529
0.0000	0.1564	0.0000	11.1397	0.0000	0.0000	0.0000

909.875000

-999.2500	2712.6460	0.2886	23.3987	23.3987	13.6129	12.4744
-1.4720	90.2803	203.1093	18.7566	-999.2500	999.2500	3.7058
-999.2500	3.1093	3004.6050	3004.6050	-1.4720	86.9078	0.1456
-0.0015	0.1456	0.2886	0.1456	14.1428	0.2646	1.0000
0.0000	0.1456	0.0000	14.1428	0.0000	0.0000	0.0000

909.750000

-999.2500	2692.8137	0.2730	22.5909	22.5909	13.6821	12.6146
-1.4804	89.8492	201.9287	3.1551	-999.2500	-999.2502	4.3124
-999.2500	1.9287	2976.4451	2976.4451	-1.4804	86.3465	0.1435
0.0101	0.1435	0.2730	0.1435	14.5674	0.2598	1.0000
0.0000	0.1435	0.0000	14.5674	0.0000	0.0000	0.0000

909.625000

-999.2500	2644.3650	0.2765	18.4831	18.4831	13.4159	12.6900
-1.5010	93.3999	201.5826	-6.5861	-999.2500	-999.2500	4.3822
-999.2500	1.5826	2955.3528	2955.3528	-1.5010	89.7142	0.1590
0.0384	0.1590	0.2765	0.1590	11.8600	0.3210	0.9667
0.0000	0.1538	0.0000	11.8600	0.0000	0.0000	0.0000

909.500000

-999.2500	2586.2822	0.2996	13.9187	13.9187	12.9195	12.7016
-1.4916	98.1214	201.7126	-4.5574	-999.2500	-999.2500	3.5967
-999.2500	1.7126	2953.5940	2953.5940	-1.4916	94.2670	0.1880
0.0723	0.1880	0.2996	0.1880	8.4863	0.4490	0.8174
0.0000	0.1537	0.0000	8.4863	0.0000	0.0000	0.0000

Example # 4 LAS 2.0 Time Based Data

```
~VERSION INFORMATION
VERS.          2.0      :  CWLS LOG ASCII STANDARD -VERSION 2.0
WRAP.         NO       :  ONE LINE PER TIME STEP
#
~WELL INFORMATION
STRT  .S      0.0000      : START TIME
STOP   .S      1.5000      : STOP TIME
STEP   .S      0.3000      : STEP
NULL   .        -999.25      : NULL VALUE
COMP   .        ANY OIL COMPANY INC.      : COMPANY
WELL   .        ANY ET 12-34-12-34      : WELL
FLD    .        WILDCAT      : FIELD
LOC    .        12-34-12-34W5      : LOCATION
PROV   .        ALBERTA      : PROVINCE
SRVC   .        ANY LOGGING COMPANY INC.      : SERVICE COMPANY
DATE   .        13-DEC-86      : LOG DATE
UWI    .        100123401234W500      : UNIQUE WELL ID
#
~CURVE INFORMATION
TIME   .S      : 1  ELAPSED TIME
BFR1   .OHMM   : 2  SINGLE PROBE 1 RESISTIVITY
BSG1   .PSIG   : 3  SINGLE PROBE 1 STRAIN GAUGE PRESSURE
#
~PARAMETER INFORMATION
MRT    .DEGC   67.0      : BOTTOM HOLE TEMPERATURE
GDEPT  .M      3456.5     : GAUGE DEPTH
DFD    .KG/M3   1000.0     : MUD WEIGHT
#
~A
0.0000      0.2125      16564.1445
0.3000      0.2125      16564.1445
0.6000      0.2125      16564.2421
0.9000      0.2125      16564.0434
1.2000      0.2125      16564.0430
1.5000      0.2125      16564.0435
```

Example # 5 LAS 2.0 Index based data with date and time curves

```

~Version Information
VERS.          2.00
Version 2.00
WRAP.          NO
WRAP.          NO
: CWLS Log ASCII Standard -
: One line per depth step

~Well Information
#MNEP.UNIT    DATA
#-----: DESCRIPTION
#-----: -----
STRT.na       1
STOP.na       16
STEP.na       1
NULL.         -999.250
COMP.          A CANADA LTD.
WELL.          A 10-16-39-3
FLD.           Wildcat
PROV.          ALBERTA
CTRY.          CANADA
LOC.           100/10-16-039-03W5/00
SRVC.          Weatherford
UWI.           100101603903W500
LIC.           0323470
DATE.          25-Jul-2008
#
#Other
-This example illustrates how date and time information can be expressed as a number
and can be included in the data section of LAS 2.0 files.
-An an index number (INDEX) is used in this example as the primary (index) curve. The
curve "TIME" could have been used as the primary curve if moved to the first curve
position.
#
~Curve Information
INDEX.na       : Index (line number)
TIME.SEC        : Elapsed time
DATE_1.         : Date YYYYMMDD (see ISO 8601)
DATE_2.         : Ordinal Date YYYYDDD (see ISO 8601)
TIME_1.         : Time hhmmss.s (see ISO 8601)
TIME_2.         : Time hhmmss (see ISO 8601)
TIME_3.         : Time hhmm (see ISO 8601)
TPRE.S          : Pretest Time
QDPF.KPAA      : Quartzdyne Pressure
BIT.MM          : Bit size
#
#1 INDEX    TIME    DATE_1   DATE_2   TIME_1    TIME_2    TIME_3    TPRE     QDPF     BIT
~A
1      0        20080725 2008177 153000.0 153000  1530    -999.250 -999.250 251.000
2      0.6      20080725 2008177 153000.6 153001  1530    -999.250 -999.250 251.000
3      1.2      20080725 2008177 153001.2 153001  1530    -999.250 -999.250 251.000
4      1.8      20080725 2008177 153001.8 153002  1530    -999.250 -999.250 251.000
5      2.4      20080725 2008177 153002.4 153002  1530    -999.250 9224.281 251.000
6      3.0      20080725 2008177 153003.0 153003  1530    -999.250 -999.250 251.000
7      3.6      20080725 2008177 153003.6 153004  1530    -999.250 -999.250 251.000
8      4.2      20080725 2008177 153004.2 153004  1530    -999.250 -999.250 251.000
9      4.8      20080725 2008177 153004.8 153005  1530    -999.250 -999.250 251.000
10     5.4      20080725 2008177 153005.4 153005  1530    1.195   9221.396 251.000
11     6.0      20080725 2008177 153006.0 153006  1530    1.794   -999.250 251.000
12     6.6      20080725 2008177 153006.6 153007  1530    2.395   -999.250 251.000
13     7.2      20080725 2008177 153007.2 153007  1530    2.999   -999.250 251.000
14     7.8      20080725 2008177 153007.8 153008  1530    3.5     -999.250 251.000
15     8.4      20080725 2008177 153008.4 153008  1530    4.156   9075.793 251.000
16     9.0      20080725 2008177 153009.0 153009  1530    4.802   -999.250 251.000

```