TEMAVG
DOCUMENTATION

ZONGE Data Processing
TEM Data Averaging Program
version 7.2x

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TEMAVG Program Documentation

OVERVIEW

TEMAVG averages GDP TEM raw data. Several files may be created, including a log file (.LOG-file), listing file (.EL-file), average data files (.AVG- or .TEM-file), plot file (.Z-file), and vector files (.Xnn-files).

INPUT FILES

TEMAVG expects to read a Data file (.FLD-file) and optionally a Mode file (.MDE-file).

The data file is usually the result of using the SHRED program to read a GDP data dump file (.RAW-file), which writes a data file (.FLD-file). This file includes data records, each containing data for one measurement. For TEM data, one record contains data measured by one channel. By default, Magnitude data are included in the .FLD-file for each window. When using the SHRED program, the user may select Resistivity values to be included instead of Magnitude data. TEMAVG expects Magnitude data and recalculates Resistivity values. The SHRED program uses the GDP data block entries for Rx and Station, and includes updated values in each data record.

The records are sorted, so that the records that need to be averaged are grouped together. Refer to the SHRED program documentation for details of this procedure and for the formats of the input and output files.

An optional mode file includes entries that modify mode values defined by Zonge Data Processing (DATPRO) programs. A mode name is specified for several program variables that a user may modify. Each line in a mode file includes the program name, mode name, and value. While running TEMAVG, help text and mode descriptions are available at the MODE prompt. An appendix to this manual summarizes the use of mode variables and includes a description of each mode defined by TEMAVG.

OUTPUT FILES

The log file (.LOG-file) includes most of the information that was displayed to the user while running TEMAVG. It is useful when reviewing the operation of the program.

The listing file (.EL-file) presents raw and/or averaged data for each station, organized for convenient review by the user. The file may be reviewed either on the screen or printed on paper. The user may be able to note problems with the data before spending time with further processing.

The plot file (.Z-file) written by TEMAVG uses a format expected by Zonge DATPRO plot programs. It contains header information and columns of data, each line including X,Y location and Z value for one parameter, optionally followed by sections for additional parameters. TEMAVG includes sections for Window Magnitude in the .Z-file for each component and frequency.

The average file (.AVG-file) includes a variety of location and parameter data in columnar format, for all pairs of components. The file is composed of sections, each of which has constant values for location and component pair. Undefined values are indicated by a "*". This format is expected of newer utility routines and some ZONGE modeling programs. The format is also suitable for use by spreadsheet, database, and plot programs.

The average file (.TEM-file) provides data in the AMIRA format. The window time file (.CHN-file) provides a list of times for use with the AMIRA format file, especially with the SIROEX modeling program.

Log-log plots of Magnitude and/or Resistivity versus Window Time, including block-average error bars, are available on the computer screen. They may be printed on paper by using the FPLOT utility program to rasterize the plot files (.Xnn-files).

SURVEY LOCATION CONVENTIONS

Zonge DATPRO programs assume that TEM survey locations are entered by the GDP operator in a specific manner. First, the Station numbers are entered explicitly for each channel, and the Rx value indicates the location of the magnetic coil or of the GDP.

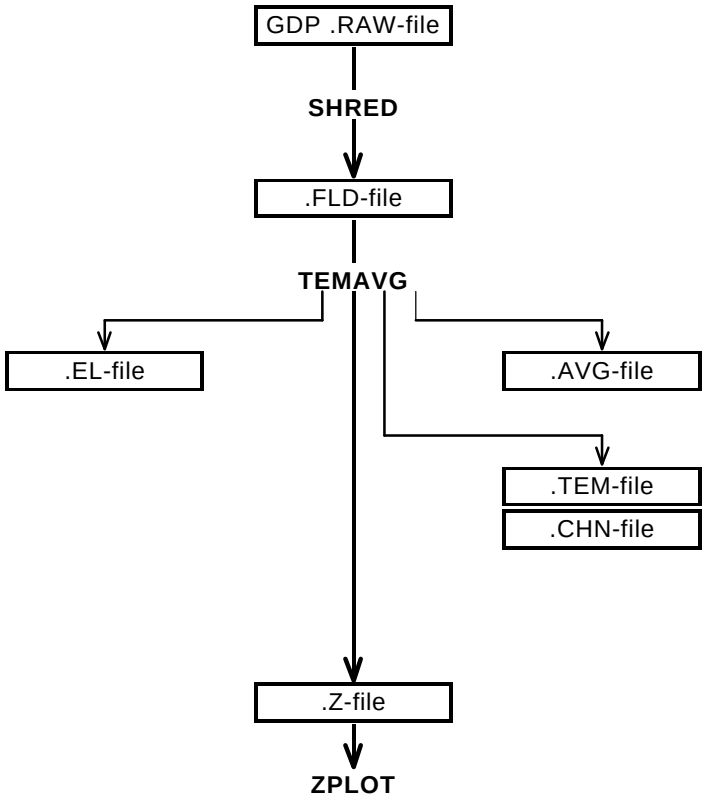
The SHRED /R- command-line argument provides an alternative interpretation. When the /R- argument is used, Rx is expected to provide a reference station location, and the Station numbers are used as offsets to the Rx value. The .FLD-file will include calculated station locations for each E-field channel.

TEM DATA PROCESSING FLOW

August, 1993

Program names are **CAPITALIZED**
File names are Boxed

Bold lines ═══ show standard GDP data processing flow.



Other files read or written:

.MDE-file | .LOG-file | .Xnn-files

TEMAVG Usage

The GENERAL DATA PROCESSING DOCUMENTATION includes many details that are common to data processing programs.

Start the averaging program by typing "TEMAVG" <RETURN>. Respond to the prompt with the name of the .FLD-file. Command line execution also allows the user to type "TEMAVG" followed by the .FLD-filename <RETURN> to automatically load the data file.

Several variable parameters called "MODES" influence the operation of TEMAVG. A brief explanation of each mode, as well as its current value, can be listed within the program. An appendix to this manual summarizes the use of mode variables and includes a description of each mode defined by TEMAVG.

TEMAVG MODE DISPLAY

```
PROCESSING MODES USED:
+==============+=========+=========+=========+=========+=========+=========+
|CONTROL MODES | AutoRun |Data     |Research | Resist. |HalfSpace| HomoRho |
|   mode names | AUTO    | AVERAGE | RESEARCH| RHOCALC | HOMO    | RHOMO   |
|  mode values |    NO   |    YES  |    NO   |   RAMP  |   NONE  |    30.om+
+==============+=========+=========+=========+=========+=========+=========+
|OUTPUT FILES  |ListFile |AvgFile  |PlotFile |DepthLim |TimeFile |TimeShift|
|   mode names | LFILE   | DFILE   | ZFILE   | DEPTH   | TIMEFILE| TOFFSET |
|  mode values |   NONE  |   AVG   |   MAG   |   NONE  |   NONE  |    NONE +
+==============+=========+=========+=========+=========+=========+=========+
|PROCESS MODES |Component|Frequency|PltSelect|TimeCutof| WinTimes| WinTimes|
|   mode names |COMPONENT|FREQUENCY| PSELECT | TCUTOFF | TIME    | WINDOWS |
|  mode values |    ALL  |   NONE  |    YES  |    0.0ms|   AUTO  |    NO   +
+==============+=========+=========+=========+=========+=========+=========+
|PLOT OPTIONS  |Log-Log  | #Curves | AxisEnds| ErrorBar| Preview |         |
|   mode names | PLOT    |NUMCURVES| PFIX    |ERRORBARS| VIEW    |         |
|  mode values |   NONE  |    10   |   TRIM  |    YES  |   NONE  |         +
+==============+=========+=========+=========+=========+=========+=========+
```

TEMAVG ERROR MESSAGES

If errors or inconsistencies arise within the program, TEMAVG may type a "NOTE" or an "ERROR" message. A "NOTE" message usually indicates some irregularity in the data file that is not fatal to program operation. Depending on the severity of the problem, an "ERROR" message may allow the program to continue to run or cause it to interrupt and wait for a response to a prompt to continue, restart the program, or to end. These messages are also included in a .LOG-file, which provides documentation of the program operation, which is especially useful when running several programs automatically from a batch file.

Note: a station whose data is split into different .FLD-files is processed as two separate stations.

TEMAVG OUTPUT SELECTIONS

TEMAVG may write a "listing" (.EL-file), average data (.AVG- or .TEM-files), a plot data (.Z-file), log-log plots with error bars, or a screen display of the station curves as they are created (see mode "VIEW"). .AVG- and .Z-files are automatically created by TEMAVG with default values for the mode variables "DFILE" and "ZFILE". An .EL-file is NOT created with the default value for the mode variable "LFILE".

Log-log plots with error bars may be generated with TEMAVG by setting the "PLOT" mode variable to one of three optional values:

"PLOT= RHO" plots log-Resistivity versus log-Window Time
"PLOT= MAG" plots log-Magnitude versus log-Window Time
"PLOT= BOTH" plots log-Magnitude *AND* log-RHO vs log-Window Time

Mode "NUMCURVES" specifies the maximum number of curves per plot.

TEM APPARENT RESISTIVITY

Simple TEM apparent resistivity formulas are valid for either early-time or late-time limits, but there is no simple equation that can be applied at all times. However, TEM apparent resistivities can be obtained iteratively at all time windows by a single-parameter inversion using a uniform half-space forward model. The forward model predicts dB/dt voltages for arbitrarily transmitter loop sizes and receiver coil placements. Zonge Engineering's TEM apparent resistivity algorithm iteratively adjusts half-space resistivities until the dB/dt voltage calculated from a half-space forward model matches the observed dB/dt voltage. The iterative procedure is fast enough to be used in routine data processing.

TEM IMAGING

TEM apparent resistivities at each time window can be approximately related to depths. Nabighian, 1979, showed how the TEM response over a uniform half-space can be approximately modeled by a single current filament which diffuses downward and outward. The velocity of the current filament is proportional to sqrt(resistivity). Nekut, 1987, and Eaton, 1986, used the current filament model to develop methods for approximate imaging of subsurface resistivities. TEM's depth of investigation is directly analogous to the Bostick depth of investigation used in frequency-domain soundings. The TEM depth of investigation equation is z = 28*sqrt(res*t), where z is the depth of investigation in meters, res is the average resistivity in ohm-m and t is window time in milliseconds. Just as the slope of log(MT apparent resistivity) versus log(frequency) can be used to calculate Bostick image resistivities in frequency-domain MT soundings, the slope of log(TEM apparent resistivity) versus log(time) can be used to generate image resistivities in TEM soundings.

RESISTIVITY and IMAGING REFERENCES

Eaton, P. A., 1986, Technique for rapidly estimating resistivity of the earth from transient electromagnetic soundings: 56th Ann. Internat. Mtg., Soc. Expl. Geophys., 52-54.

Nabighian, M. N., 1979, Quasi-static response of a conducting half-space: An approximate representation: Geophysics, 44, 1700-1705.

Nabighian, M. N. and Macnae, J. C., 1991, Time domain electromagnetic prospecting methods, in Nabighian, M. N., Ed., Electromagnetic methods in applied geophysics, 2: Soc. Expl. Geophys., 427-520.

Nekut, A. G., 1987, Direct inversion of time-domain electromagnetic data: Geophysics, 52, 1431-1435.

TEMAVG Sample Run

Input files:	SAMTEM.FLD	SAMTEM.MDE	
Output files:	SAMTEM.LOG	SAMTEM.EL	log and listing files
	SAMTEM.AVG		average data files
	SAMTEM.Z	SAMTEM.Xnn	XYZ and plot files

```
*** Bold text: user input and comments ***

C:> TEMAVG SAMTEM                    *** Start program, specify data file

ZONGE ENGINEERING: 3322 E. Fort Lowell, Tucson AZ 85716, USA
TEMAVG 7.20: TRANSIENT EM FIELD DATA AVERAGING PROGRAM.
   MS-DOS version implemented 01 August, 1993.

MODE   CLIENT=ZONGE ENGINEERING                *** entries from .MDE-file
MODE  PROJECT=TEM Sample Data
MODE  JOBNUMB=9001
MODE  JOBDATE=Dec 90
       :
MODE  PLOT = Mag
MODE  PFIX = Set
MODE  VMIN = -7
MODE  PSEL = No
MODE  NUMC = 4
MODE  LIST = Both

(Type MENU for assistance with MODEs.)

MODE Change [name?, name= value] : PLOT= Rho     *** Enable Plots
MODE Change [name?, name= value] : PFIX= Set     *** Use bounds specified
MODE Change [name?, name= value] : VMIN= -7      *** Magnitude min = 10-7
MODE Change [name?, name= value] : PSEL= No      *** Don't separate curves
MODE Change [name?, name= value] : NUMC= 4       *** Max curves per plot
MODE Change [name?, name= value] : <RETURN>      *** Continue

Reading "SAMTEM.FLD" . . .

 Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment
 AVG                -.5     4 INL  Hz            50%  222.4u     10000.0
 AVG                -.5    16 INL  Hz            50%  49.20u     10000.0
 AVG                -.5     4 INL  Hz            50%  222.4u     10000.0
 AVG                -.5    16 INL  Hz            50%  49.20u     10000.0
File: "SAMTEM.X01"     17078 bytes, ready for rasterizing.
 AVG                 .5     4 INL  Hz            50%  222.4u     10000.0
 AVG                 .5    16 INL  Hz            50%  49.20u     10000.0
 AVG                 .5     4 INL  Hz            50%  222.4u     10000.0
 AVG                 .5    16 INL  Hz            50%  49.20u     10000.0
File: "SAMTEM.X02"     16526 bytes, ready for rasterizing.

        ...

 AVG               3.5     4 INL  Hz            50%  222.4u     10000.0
 AVG               3.5    16 INL  Hz            50%  49.20u     10000.0
 AVG               3.5     4 INL  Hz            50%  222.4u     10000.0
 AVG               3.5    16 INL  Hz            50%  49.20u     10000.0
File: "SAMTEM.X05"     16293 bytes, ready for rasterizing.
 AVG               4.5     4 INL  Hz            50%  222.4u     10000.0
 AVG               4.5    16 INL  Hz            50%  49.20u     10000.0
 AVG               4.5     4 INL  Hz            50%  222.4u     10000.0
 AVG               4.5    16 INL  Hz            50%  49.20u     10000.0
File: "SAMTEM.X06"     17318 bytes, ready for rasterizing.

Combine .Z-file data . . .
Files ready for rasterizing:
 SAMTEM.X01 thru SAMTEM.X06

Log file "SAMTEM.LOG" closed.

Data filename [quit]: <RETURN>               *** No more files
Thank You !!
```

Appendix A ... MODE VARIABLES

Control of various aspects of many data processing programs is provided by names called "Modes". Each name refers to a specific program function. For example, the Mode name "AUTO" refers to the automatic mode of program operation, which the user may enable.

Mode changes are recognized when prompted by a program, when read from a Mode file, or when included in an input data file.

MODE PROMPTS, Manual entry

The first prompt after a data filename is requested is commonly a mode prompt. In the following example, user requests are in BOLD type, and the results are typical responses.

```
(Type MENU for assistance with MODEs.)

MODE Change [name?, name= value] : MENU

PROCESSING MODE MENU:   Review and changing of mode values.
Change value: type "NAME= value", where NAME is the variable
              name, followed by "= ", then the value to be
              assigned to the variable called NAME.
Description : type "NAME?" for description of value.
This menu   : type "MENU", or "M", to list this menu.
List globals: type "GLOBL" or "G", to list global mode values.
List values : type "LOCAL" or "L", to list local mode values.
Version info: type "VRSN", or "V", for program version info.
Back up     : type <CRTL><Z> to back up in program.
All done    : type <RETURN>.

MODE Change [name?, name= value] : LIST

   PROCESSING MODE LIST:   (Type MENU for assistance)
```

CONTROL MODES	AutoRun	LowFreq	InitGain	GridOrgX	GridOrgY
mode names	AUTO	FMIN	(not yet)	GORX	GORY
mode values	YES	1/16 Hz	NONE	NONE	NONE

```
MODE Change [name?, name= value] : AUTO?

AUTO mode will automatically delete existing output files (if
any), not prompt for MODE changes (if AUTO= YES is included in the
.MDE-file, and exit when completed.  Plots will be done as
specified by entries in the .MDE-file (MODE PLOT and VIEW).
Enter: AUTO= No, or Yes.

MODE Change [name?, name= value] : AUTO= yes

MODE Change [name?, name= value] : <RETURN>

(the program continues ...)
```

Display a definition of any Mode by typing the variable name and a question mark (as shown for Mode AUTO). Each program manual includes an appendix of mode definitions defined by that program.

Change the value of a Mode by typing the variable name, an equals sign, and a valid value. Press <RETURN> to indicate that the program should continue.

MODE CHANGE PRIORITIES

Mode changes may be manually entered, added to mode files or to input data files. Mode statements in files include the program name (optional), the Mode name, and the Mode value. Include a dollar sign ($) in the first column, a colon (:) after the program name (if any), and an equal sign after the Mode name such as:

```
$ ZPLOT: AUTO= yes
```

Modes will NOT be changed unless they are from a source with the same or higher priority as the entry to be replaced:

1: default mode values
2: Mode lines in input data files
3: Mode lines in Mode files (global or local)
4: Mode changes made at a MODE prompt

LOCAL MODE FILES

The program will read a Mode file (if it exists) with the same name as the data file and an extension of ".MDE" (like LINE10.MDE). Specify a different Mode file from the DOS prompt, by entering the program name, data file name, then Mode file name. Include the filename extension if not the same as the default. For example:

Start ZPLOT by:			ZPLOT looks for files named:	
C:> ZPLOT	LINE10		LINE10.Z	LINE10.MDE
C:> ZPLOT	LINE10	PROJECT	LINE10.Z	PROJECT.MDE
C:> ZPLOT	LINE10.ZZ	PROJECT.MOD	LINE10.ZZ	PROJECT.MOD

GLOBAL MODE FILES

Frequently used Mode statements may be included in a file named "DATPRO.MDE" and located in any subdirectory included on your PATH. Or, the environment variable DATMDE may specify any Mode file located anywhere on your computer. One of these files will be used automatically by the program, in addition to any local mode file. Your MS-DOS manuals describe environment variables and PATH.

DATA FILE MODE STATEMENTS

Mode statements may be included in an input data file (near the top of the file). Some programs will include Mode statements in output data files, for use by subsequent programs.

TEMAVG MODE LIST
(v 7.2x)

PROCESSING MODE DEFAULT VALUES:

CONTROL MODES	AutoRun	Data	Research	Resist.	HalfSpace	HomoRho
mode names	AUTO	AVERAGE	RESEARCH	RHOCALC	HOMO	RHOMO
mode values	NO	YES	NO	RAMP	NONE	30.om
OUTPUT FILES	ListFile	AvgFile	PlotFile	DepthLim	TimeFile	TimeShift
mode names	LFILE	DFILE	ZFILE	DEPTH	TIMEFILE	TOFFSET
mode values	NONE	AVG	MAG	NONE	NONE	NONE
PROCESS MODES	Component	Frequency	PltSelect	TimeCutof	WinTimes	WinTimes
mode names	COMPONENT	FREQUENCY	PSELECT	TCUTOFF	TIME	WINDOWS
mode values	ALL	NONE	YES	0.0ms	AUTO	NO
PLOT OPTIONS	Log-Log	#Curves	AxisEnds	ErrorBar	Preview	
mode names	PLOT	NUMCURVES	PFIX	ERRORBARS	VIEW	
mode values	NONE	10	TRIM	YES	NONE	

When mode PFIX=SET the following modes are also displayed:

AXIS LIMITS	MAG_Axis_Limits		TIME_Axis_Limits		RHO_Axis_Limits	
mode names	VMIN	VMAX	TMIN	TMAX	RMIN	RMAX
mode values	NONE	NONE	NONE	NONE	NONE	NONE

COMPANY
Company name (40 chr max)

Values: COMPANY= Name of survey company
Default: COMPANY= (blank)

CLIENT
Client name (40 chr max)

Values: CLIENT= Company requesting the survey
Default: CLIENT= (blank)

PROJECT
Project name (40 chr max)

Values: PROJECT= Name of the survey project.
Default: PROJECT= (blank)

JOBNUMBER
Company job number (10 chr max)

Values: JOBNUMBER= Survey Job Number.
Default: JOBNUMBER= (blank)

JOBDATE
Survey date (10 chr max)

Values: JOBDATE= Date of Survey.
Default: JOBDATE= (blank)

JOBLINE
Survey line number (10 chr max)

Values: JOBLINE= Survey Line Number.
Default: JOBLINE= (blank)

BRGLINE
Line forward bearing (10 chr max)

Values: BRGLINE= Line Bearing, to high stn.
Default: BRGLINE= (blank)

BRGBACK
Line back bearing (10 chr max)

Values: BRGBACK= Back Bearing, to low stn.
Default: BRGBACK= (blank)

STNLOW
Low station number, plot limit

Values: STNLOW= X-axis low station limit.
Default: STNLOW= NONE

STNHIGH
High station number, plot limit

Values: STNHIGH= X-axis high station limit.
Default: STNHIGH= NONE

STNDELT
Station number increment, plot scale

Values: STNDELT= X-axis station increment.
Default: STNDELT= 1.0

LBLFRST
Low station number, axis label

Values: LBLFRST= X-axis low station label.
Default: LBLFRST= mode STNLOW value.

LBLDELT
Station number increment, axis label

Values: LBLDELT= X-axis station label increment.
Default: LBLDELT= 1.0

FRQLO
Low frequency, plot limit

Values: FRQLO= None, or low frequency limit, Hz.
Default: FRQLO= NONE

FRQHI
High frequency, plot limit

Values: FRQHI= None, or high frequency limit, Hz.
Default: FRQHI= NONE

TXLEN
CSAMT Transmitter length (10 chr max)

Values: TXLEN= CSAMT Transmitter Length
Default: TXLEN= (blank)

TXBRG
CSAMT Transmitter bearing (10 chr max)

Values: TXBRG= CSAMT Transmitter Bearing
Default: TXBRG= (blank)

TXDIS
CSAMT Transmitter distance from survey line (10 chr max)

Values: TXDIS= Distance from Rx Line to Tx
Default: TXDIS= (blank)

TXCX
CSAMT Transmitter center, X-coordinate
If units in feet or meters are not included, mode UNITS will be used.

Values: TXCX=
X-coordinate of center of Tx dipole. (10 chr max)
Default: TXCX= (blank)

TXCY
CSAMT Transmitter center, Y-coordinate
If units in feet or meters are not included, mode UNITS will be used.

Values: TXCY=
Y-coordinate of center of Tx dipole. (10 chr max)
Default: TXCY= (blank)

RX2TX
CSAMT Receiver to Transmitter direction

Values: RX2TX=
Direction from Rx Line to Tx (10 chr max)
Default: RX2TX= (blank)

RXBRG
Receive dipole bearing, usually same as survey line orientation

Values: RXBRG=
Receiver Dipole Bearing (10 chr max)
Default: RXBRG= (blank)

COMWIRE
Communications wire type, used for decalibration of GDP-12 data

Values: COMWIRE= NONE,
1WHITE, 2WHITE, or BLACK.
Default: COMWIRE= NONE

PLTREV
Plot X-axis reverse selection

Values: PLTREV= No, or Yes.
Default: PLTREV= NO

UNITS
Units for listed values, such as A-Spacing. Feet or meters.

Values: UNITS= Feet or Meters.
Default: UNITS= Meters

AUTO
AUTO mode will automatically delete existing output files (if any), not prompt for MODE changes (if AUTO= YES is included in the .MDE-file), and exit when completed. Plots and output files will be according to default values or as specified by MODE entries in the .MDE-file.

Values: AUTO= No, or Yes.
Default: AUTO= No

AVERAGE
Raw or Averaged data results may be selected by Mode AVERAGE.

When selecting Raw, not Averaged data, modes ZFILE and DFILE are ignored, and no .Z- or .AVG-file will be written. Mode ERRORBAR is ignored, no errorbars on plotted data.

Values: AVERAGE= No, or Yes.
Default: AVERAGE= Yes

RESEARCH
TEMAVG recalculates Window1Time, allowing the delay times to be adjusted for incorrect entries during data acquisition, and for testing purposes.

HardwareDelays= TransmitterDelay + AntennaDelay + AntiAliasFilterDelay
Window1Time = SamplingDelay - HardwareDelays

SamplingDelay is an integral multiple of the sample period. The GDP sets SamplingDelay to be greater than HardwareDelays.

RESEARCH mode provides for replacing the Window1Time with an operator selected value. If the Window1Time recalculated by TEMAVG is negative, one or more of the delay times have been manually edited. The value entered for the Sampling Delay will be used as Window1Time, and the SamplingDelay is undefined.

If RESEARCH mode is off, the recalculated Window1Time will be used. Various notes will be displayed when the data file Window1Time does not match the recalculated value, whether or not RESEARCH mode is set.

Values: RESEARCH= No, or Yes.
Default: RESEARCH= No

RHOCALC
Resistivity calculations are made according to the GDP array type:

IN-LOOP (CENTRAL-LOOP) arrays
(GDP INL array type)

1. RHOCALC = RAMP (default)
Sandberg, S.K., 1988, Microcomputer Software for the processing and forward modelling of transient electromagnetic data taken in the central loop sounding configuration: N.J.G.S., Open-File Report 88-1. Modified from the program RAMPRES.FOR v1.12.

2. RHOCALC = IMAGE
Same as RAMP-CORRECTED APPARENT RESISTIVITY, followed by a Niblett-Bostick transformation generates a 1st-order image resistivity.

3. RHOCALC = STEP
Paul Raab and Frank Frischknecht (1983, USGS Open-file Report 83-240), modified by Stewart Sandberg (1988, NJGS Open-file Report 88-1 (Program TEMRES)). The late time calculations are provided.

4. RHOCALC = COL
COINCIDENT LOOP resistivity calculations may be used, if the receiver moment is normalized to the area of the transmitter moment. Late time values will be very close, early time values may vary by 15%. The GDP calculates resistivities by this procedure.

COINCIDENT-, SINGLE-, OFFSET-LOOP arrays
(GDP COL array type)
Mode RHOCALC is ignored.
Spies and Raiche, Geophysics, Vol.45, No.7 (July 1980): p.1197-1204

MOVING-LOOP FIXED-LOOP LOTEM (DIPOLE)
(GDP MVL FXL LOT array types)
Mode RHOCALC is ignored.
Resisitivity calculations have not been defined.

Values: RHOCALC= RAMP, IMAGE, STEP, or COL. (INL data only)
Default: RHOCALC= RAMP

HOMO
Removal of HOMOGENEOUS HALF-SPACE response from raw data.

HOMO = NONE NO REMOVAL of homogeneous half-space response.
HOMO = REMOVE REMOVE homogeneous half-space response.
HOMO = LIST LIST results to terminal, AFTER removal of homogeneous half-space response.
HOMO = SWAP SWAP (replace) the field data with the response.

NOTE: The user may toggle in and out of display mode (HOMO=REMOVE <--> HOMO=LIST) with the SCROLL_LOCK key.

NOTE: Mode HOMO is not resetable after the .FLD-file has been read, since the response is removed as the data is being read. Return to the .FLD-file prompt, then you may change this mode.

The half-space resistivity is set by mode RHOMO.
The Station value is the X-Coordinate. (X = Rx)
The Transmitter value is the Y-Coordinate. (Y = Tx)
Coordinates are expected to be in meters.
The Loop Center is Origin (0,0).

Values: HOMO= NONE, REMOVE, LIST, or SWAP.
Default: HOMO= NONE

RHOMO
RHOMO is the HOMOGENEOUS HALF-SPACE resistivity used to calculate the half-space response. The half-space response is removed from raw magnitude data as specified by mode HOMO.

Values: RHOMO= value, positive number.
Default: RHOMO= 30.om

LFILE
Write .EL-files with a choice of data for review.
LFILE = NONE no listing file will be written.
LFILE = RAW Include each raw channel
LFILE = AVG Include each averaged data set
LFILE = BOTH Include raw and averaged data

Values: LFILE= NONE, RAW, AVG, or BOTH.
Default: LFILE= NONE

DFILE
Write .AVG- or .TEM-files with a choice of values.
DFILE= NONE no data file will be written.
DFILE= AVG write an .AVG-file.
DFILE= AMIRA write .TEM- and .CHN-files, using the AMIRA TEM format.
Mode RHOCALC selects method for calculating resistivity values.
Mode COMPONENT selects which component to include, if not all data.
When mode AVERAGE is Off, data files will NOT be written.

Values: DFILE= NONE, AVG, or AMIRA.
Default: DFILE= AVG

ZFILE
Write .Z-files with a choice of values for use by plotting programs.
ZFILE= NONE no plot file will be written.
ZFILE= MAG write TIME vs MAGNITUDE. Data are configured for Profile Plots.
ZFILE= RHO write TIME vs RESISTIVITY.
ZFILE= DEPTH write DEPTH(meters) vs RESISTIVITY (only for InLoop array).
NanoTEM calculated for the InLoop configuration.
Data are configured for Pseudosection Plots.
Plot file parameters are fixed, and may need adjustments.
Mode RHOCALC selects method for calculating resistivity values.
Mode COMPONENT selects which component to include, if not all data.
When mode AVERAGE is Off, data files will NOT be written.

Values: ZFILE= NONE, MAG, RHO, or DEPTH.
Default: ZFILE= MAG

DEPTH
The diffusion depth values written when mode ZFILE=DEPTH may be limited when mode DEPTH is specified. Do not include units, as "100m" will be interpreted as 100 milli-units. The value should be entered using the same units as specified by mode UNITS.

Depth values are expected to increase with time. When a depth value is less than the previous depth, it and remaining data are written with the SKP column set to zero (skip).

While not skipped, when a depth value is greater than specified by mode DEPTH, a resistivity value will be interpolated (linearly) at the depth limit, and remaining data will be skipped. Use DEPTH=0 when no limit should be used.

Mode ZFILE specifies when to include depth instead of time values.

Values: DEPTH= Limit of .Z-file diffusion depths
Default: DEPTH= 0

TIMEFILE
Mode TIMEFILE may specify a .TIM-file containing a list of window times. Unaveraged decay curves will be used to interpolate magnitudes at each window time provided. The results replace the original data.

Data at GDP window times are adjusted for comparison with data at other sets of times. GDP times are adjusted to the top of the Tx turnoff ramp by adding the TxTurnoffTime to each window time. The times may be shifted from the top of the ramp by using mode TOFFSET to specify an offset value to be added to window times.

.TIM-file times that require extrapolating from the original data will not be included in the results. The times are expected to measure from the beginning of the Tx turnoff ramp. File entries are expected to be one per record (line), in milliseconds.

The SamplingDelay, by definition, is the Window1Time as measured from time T0. From the viewpoint of the GDP, the beginning of the Tx turnoff ramp occurs after time T0, after the intervals defined as the AntennaDelay and the AliasFilterDelay. The TxTurnoffTime defines the additional interval before the beginning of GDP measurements at the end (bottom) of the Tx turnoff ramp. So, the SamplingDelay is the sum of the AntennaDelay, AliasFilterDelay, TxTurnoffTime and Window1Time.

Values: TIMEFILE=
Filename containing interpolation times.
Default: TIMEFILE= NONE

TOFFSET
When using mode TIMEFILE, the original GDP times are shifted from the bottom of the transmitter turnoff ramp, to measure from the top of the ramp. An additional time may be added, specified by mode TOFFSET, in milliseconds (Note: .RAW-file delays are specified in micro-seconds). Magnitude values are then interpolated and processed at the times included in the .TIM-file.

If not using mode TIMEFILE, the original GDP times are shifted by the mode value. If mode TOFFSET=TOP, original GDP window times will be shifted to the top of the ramp.

Values: TOFFSET= value, in milliseconds.
Default: TOFFSET= NONE

COMPONENT
COMPONENT selects data of a specific component for log-log plots, and for writing .Z-, .AVG, and .TEM-files.

COMPONENT =
- ALL all components will be included.
- Hx include Hx component data only.
- Hy include Hy component data only.
- Hz include Hz component data only.
- Ex include Ex component data only.
- Ey include Ey component data only.
- Ez include Ez component data only.

Values: COMPONENT=
ALL, Hx, Hy, Hz, Ex, Ey, or Ez.
Default: COMPONENT= ALL

FREQUENCY
FREQUENCY selects data of one frequency for log-log plots. When the data file contains data of various frequencies for each station, log-log plots will contain curves for one station at one frequency. To include curves of several stations on one plot, use mode FREQUENCY to specify one frequency.

FREQUENCY = NONE plots will not combine frequencies and stations.
FREQUENCY = 1 plots will include 1 Hz curves (mode NUMCURVES).

Data written to .Z- and .AVG-files are not affected, they are automatically segregated by frequency.

Values: FREQUENCY=
NONE, or binary frequency in Hertz.
Default: FREQUENCY= NONE

PSELECT
Data curves are not combined on one plot when any of the following parameters changes: Frequency, Loop, DutyCycle, Window1Time, or RxNA. Select PSELECT=NO to disable this restriction.

Values: PSELECT= No, or Yes.
Default: PSELECT= Yes

TCUTOFF
TCUTOFF provides a cutoff time, in milliseconds. A value that is greater than zero will limit the late-time data points on log-log plots (MAG and/or RHO vs TIME), and in .Z- and .AVG-files.

Values: TCUTOFF= value, positive number.
Default: TCUTOFF= 0.0ms

TIME
Mode TIME selects a list of window times, for either GDP or SiroTem.
These times are related by window number only, not actual time.

TIME = AUTO GDP version and Array Type determine window times.
TIME = NT 31 windows, GDP NanoTEM.
TIME = 31 31 windows, GDP version 0521.
TIME = 3b 31 windows, GDP version 0526.
TIME = 28 28 windows, GDP-16 version 0507.

Values: TIME= AUTO, NT, 31, 3b or 28.
Default: TIME= AUTO

WINDOWS
Mode WINDOWS will include a list of window centers for each frequency. The list will be included in the summary listing, either by itself or with the selected listing information (at the end of the file).

Values: WINDOWS= No, or Yes.
Default: WINDOWS= No

PLOT
Printed plots are available for:

PLOT= NONE No plots displayed or generated
PLOT= MAG log-TRANSIENT vs log-TIME
PLOT= RHO log-RESISTIVITY vs log-TIME
PLOT= BOTH log-TRANSIENT *AND* log-RHO vs log-TIME

See mode NUMCURVES to specify the number of averaged curves per plot.
See mode ERRORBARS to include block average errorbars for each curve.

See mode COMPONENT to select data for one specific component.
See mode VIEW to enable plot preview on screen.
See mode AVERAGE for unaveraged data plots.

Values: PLOT= NONE, MAG, RHO, or BOTH.
Default: PLOT= NONE

NUMCURVES
Limit the maximum number of curves per plot by "NUMCURVES= n".
A change in Array Type, Frequency, Window 1 Time, Duty Cycle, or Receiver Moment will also limit the data curves for one plot.

If NUMCURVES= 0, then the number of curves per plot is limited to curves for one station and one component.

See mode PLOT for specifying plots of log-TRANSIENT and/or log-RESISTIVITY vs log-TIME.
See also the descriptions for modes VIEW, AVERAGE and COMPONENT.

Values: NUMCURVES= 0 or N curves per plot, up to 40.
Default: NUMCURVES= 10

PFIX
PFIX specifies the method by which the ends of the axes will be determined.

PFIX= AUTO allows the program to define the limits of the axes for each plot, so that all data for each set of curves will be plotted as large as will fit.
PFIX= TRIM acts as does AUTO. In addition, the range of the axes are limited to 5 decades below the max value.
PFIX= SET will allow the user to specify the miminum and/or maximum limits for the end(s) of any axes, and the values will be used for all plots. Ends that are not limited will auto adjust to include the curves. Curves will be clipped to fall within the axes. Limits will be checked to be sure the minimum is less than the maximum for ends defined manually and/or automatically.

See VMIN, VMAX, TMIN, TMAX, RMIN and RMAX descriptions.
The MODE listing will display these values when mode PFIX= SET.

Values: PFIX= AUTO, TRIM, or SET.
Default: PFIX= TRIM

ERRORBARS
Error bars are available for averaged data only. When plots of both magnitude and resistivity are requested, errorbars will be included only on magnitude data.

Magnitude data are averaged arithmetically. The variation (sigma) is displayed as a percentage (coefficient of variation) in the .EL-file (data listing). Error bars greater than a minimum value (10%) are drawn between log(Avg) + log(1 +/- Cvar/100). The same symbol used for the data curve is displayed over the error bar endpoints.

When mode AVERAGE is Off, errorbars will NOT be plotted.

Values: ERRORBARS= No, or Yes.
Default: ERRORBARS= Yes

VIEW
A screen plot of station curves as they are created may be selected by mode VIEW. The plot will be scaled to fit on one screen.

Values: VIEW= None, or Screen.
Default: VIEW= None

VMIN
VMIN sets a minimum value for the voltage (transient) axis. The value is used as 10.**n, n an integer. Limits may be set at any time prompted by MODE Change: but they will be used and displayed only when PFIX= SET. VMIN is expected to be within the range of -10 to 10. To remove a limiting value, specify "VMIN= NONE".

Values: VMIN= NONE, or integer exponent.
Default: VMIN= NONE

VMAX
VMAX sets a maximum value for the voltage (transient) axis. The value is used as 10.**n, n an integer. Limits may be set at any time prompted by MODE Change: but they will be used and displayed only when PFIX= SET. VMAX is expected to be within the range of -10 to 10. To remove a limiting value, specify "VMAX= NONE".

Values: VMAX= NONE, or integer exponent.
Default: VMAX= NONE

TMIN
TMIN sets a minimum value for the time (delay) axis. The value is used as 10.**n, n an integer. Limits may be set at any time prompted by MODE Change: but they will be used and displayed only when PFIX= SET. TMIN is expected to be within the range of -10 to 10. To remove a limiting value, specify "TMIN= NONE".

Values: TMIN= NONE, or integer exponent.
Default: TMIN= NONE

TMAX
TMAX sets a maximum value for the time (delay) axis. The value is used as 10.**n, n an integer. Limits may be set at any time prompted by MODE Change: but they will be used and displayed only when PFIX= SET. TMAX is expected to be within the range of -10 to 10. To remove a limiting value, specify "TMAX= NONE".

Values: TMAX= NONE, or integer exponent.
Default: TMAX= NONE

RMIN
RMIN sets a minimum value for the apparent resistivity axis. The value is used as 10.**n, n an integer. Limits may be set at any time prompted by MODE Change: but they will be used and displayed only when PFIX= SET. RMIN is expected to be within the range of -10 to 10. To remove a limiting value, specify "RMIN= NONE".

Values: RMIN= NONE, or integer exponent.
Default: RMIN= NONE

RMAX
RMAX sets a maximum value for the apparent resistivity axis. The value is used as 10.**n, n an integer. Limits may be set at any time prompted by MODE Change: but they will be used and displayed only when PFIX= SET. RMAX is expected to be within the range of -10 to 10. To remove a limiting value, specify "RMAX= NONE".

Values: RMAX= NONE, or integer exponent.
Default: RMAX= NONE

Appendix B ... SAMPLE FILES

Sample .LOG-file

```
TEMAVG 7.20, Processed: 04 Aug 93

GLOBAL MODE LIST:
+=============================================+==============+==============+
|  COMPANY                                    |  JOBNUMB     |  TXLEN       |
|  Zonge Engineering                          | 9001         |              |
|  CLIENT                                     |  JOBDATE     |  TXBRG       |
|  ZONGE ENGINEERING                          | Dec 90       |              |
|  PROJECT                                    |  JOBLINE     |  TXDIS       |
|  TEM Sample Data                            | 5            |              |
+==============+==============+==============+==============+              |
|  BRGBACK     |  RXBRG       |  BRGLINE     |  FRQLO       |  RX2TX       |
|  S 90 W      |  East        |  N 90 E      |     1.0 Hz   |              |
|  STNLO       |  STNDELT     |  STNHI       |  FRQHI       |  TXCX        |
|     11.1     |     1.1      |     16.6     |     16. Hz   |              |
|  LBLFRST     |  LBLDELT     |  PLTREV      |  UNITS       |  TXCY        |
|  STNLO       |     1.1      |     NO       |  FEET        |              |
+==============+==============+==============+==============+==============+

PROCESSING MODES USED:
+==============+=========+=========+=========+=========+=========+=========+
|CONTROL MODES | AutoRun |Data     |Research | Resist. |HalfSpace| HomoRho |
|   mode names | AUTO    | AVERAGE | RESEARCH| RHOCALC | HOMO    | RHOMO   |
|  mode values |    NO   |    YES  |    NO   |   RAMP  |   NONE  |   30.om+
+==============+=========+=========+=========+=========+=========+=========+
|OUTPUT FILES  |ListFile |AvgFile  |PlotFile |DepthLim |TimeFile |TimeShift|
|   mode names |  LFILE  |  DFILE  |  ZFILE  |  DEPTH  | TIMEFILE| TOFFSET |
|  mode values |   NONE  |    AVG  |   DEPTH |   2000. |   NONE  |    NONE +
+==============+=========+=========+=========+=========+=========+=========+
|PROCESS MODES |Component|Frequency|PltSelect|TimeCutof| WinTimes| WinTimes|
|   mode names |COMPONENT|FREQUENCY| PSELECT | TCUTOFF | TIME    | WINDOWS |
|  mode values |    ALL  |    NONE |    NO   |    0.0ms|   AUTO  |    NO   +
+==============+=========+=========+=========+=========+=========+=========+
|PLOT OPTIONS  |Log-Log  | #Curves | AxisEnds| ErrorBar| Preview |         |
|   mode names |  PLOT   |NUMCURVES|  PFIX   |ERRORBARS| VIEW    |         |
|  mode values |    MAG  |     4   |    SET  |    YES  |   NONE  |        +
+==============+=========+=========+=========+=========+=========+=========+
|AXIS LIMITS   | MAG_Axis_Limits   | TIME_Axis_Limits  | RHO_Axis_Limits   |
|   mode names | VMIN    + VMAX    | TMIN    + TMAX    | RMIN    + RMAX    |
|  mode values |  -7.    |  -1.    |  -2.    |   2.    |   NONE  |   NONE  +
+==============+=========+=========+=========+=========+=========+=========+

Reading "SAMTEM.FLD" . . .
 Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment Ts
 AVG                -.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                -.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                -.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                -.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                 .5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                 .5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                 .5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                 .5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                1.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                1.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                1.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                1.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                2.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                2.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                2.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                2.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                3.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                3.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                3.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                3.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                4.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                4.5   16 INL  Hz            50%  49.20u     10000.0 28
 AVG                4.5    4 INL  Hz            50%  222.4u     10000.0 28
 AVG                4.5   16 INL  Hz            50%  49.20u     10000.0 28

Combine .Z-file data . . .
Combine .AVG-file data . . .
File "SAMTEM.AVG" contains averaged data for  24 data sets.

Files ready for rasterizing:
 SAMTEM.X01 thru SAMTEM.X06

Log file "SAMTEM.LOG" closed.
```

Sample .EL-file (partial: only data for Stn= -0.5)

```
From TEMAVG 7.20 using input file "SAMTEM.FLD": 05 Aug 93

In Loop (Central Loop)       Tx length (X)=   633. ft, Tx width (Y)=   633. ft
Tx turn-off= 155.0 us        Sampling delay= 486.4 us
App_Res are Ramp-Corrected Apparent Resistivity values

Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment Ts
0270 0003 1 0      -.5     4 INL  Hz  144  5.0  50%  222.4u 25  10000.0 28   1
Wn   Time     V/I    App_Res            Wn   Time     V/I    App_Res
 1   222.4  225.45u   696.9             14   4.096  2.0712u   185.8
 2   344.0  70.096u   835.7             15   5.062  4.5280u    77.8
 3   465.6  33.845u   879.4             16   6.327  445.90n   253.7
 4   587.2  31.240u   657.8             17   7.848  1.4370u    81.4
 5   708.8  24.114u   588.7             18   9.820  1.4384u    56.1
 6   830.4  20.154u   520.9             19   12.43  1.3582u    39.5
 7   1.010  18.306u   409.8             20   15.52  497.50n    53.4
 8   1.254  12.568u   375.6             21   19.49  432.80n    40.2
 9   1.498  13.411u   271.4             22   24.46  51.200n   114.5
10   1.741  9.9031u   261.4             23   30.72  375.30n    20.7
11   2.153  7.3451u   227.0             24   38.66  131.10n    28.6
12   2.709  3.9551u   236.8             25   48.65  501.00n     7.9
13   3.308  3.3547u   190.9

Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment Ts
0271 0004 1 0      -.5     4 INL  Hz  156  5.0  50%  222.4u 25  10000.0 28   2
Wn   Time     V/I    App_Res            Wn   Time     V/I    App_Res
 1   222.4  228.99u   689.6             14   4.096  2.4943u   164.1
 2   344.0  71.026u   828.4             15   5.062  2.6761u   110.6
 3   465.6  35.428u   852.9             16   6.327  2.0765u    90.8
 4   587.2  27.369u   718.7             17   7.848  1.6276u    74.9
 5   708.8  26.057u   558.9             18   9.820  625.00n    98.0
 6   830.4  19.254u   537.0             19   12.43  1.1016u    45.4
 7   1.010  15.451u   459.1             20   15.52  321.50n    71.5
 8   1.254  9.8338u   442.5             21   19.49  502.30n    36.4
 9   1.498  8.1882u   377.6             22   24.46  161.90n    53.1
10   1.741  8.6694u   285.8             23   30.72  348.50n    21.8
11   2.153  6.9393u   235.8             24   38.66  207.30n    21.0
12   2.709  5.7130u   185.2             25   48.65  519.60n     7.8
13   3.308  4.8226u   149.7

Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment Ts
0272 0005 1 0      -.5     4 INL  Hz  256  5.0  50%  222.4u 25  10000.0 28   3
Wn   Time     V/I    App_Res            Wn   Time     V/I    App_Res
 1   222.4  226.48u   694.7             14   4.096  2.5380u   162.2
 2   344.0  67.617u   856.1             15   5.062  3.9472u    85.3
 3   465.6  35.027u   859.4             16   6.327  2.4477u    81.3
 4   587.2  29.722u   680.1             17   7.848  464.00n   173.1
 5   708.8  24.396u   584.1             18   9.820  1.5731u    52.9
 6   830.4  21.425u   500.0             19   12.43  365.10n    94.9
 7   1.010  17.103u   428.9             20   15.52  174.40n   107.6
 8   1.254  14.444u   342.2             21   19.49  678.30n    29.8
 9   1.498  12.888u   278.7             22   24.46  288.20n    36.1
10   1.741  9.7206u   264.7             23   30.72  262.30n    26.3
11   2.153  7.6614u   220.7             24   38.66  208.00n    21.0
12   2.709  7.0215u   161.3             25   48.65  469.60n     8.3
13   3.308  2.1798u   254.6
```

*** continued next page ***

Sample .EL-file (page 2)

```
Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment Ts
0273 0006 1 0      -.5     4 INL  Hz  256  5.0  50%  222.4u 25  10000.0 28   4
Wn   Time     V/I    App_Res             Wn   Time     V/I    App_Res
 1   222.4  226.26u   695.2               14   4.096  3.6787u   126.5
 2   344.0  67.965u   853.2               15   5.062  1.9796u   135.3
 3   465.6  30.991u   932.8               16   6.327  1.7903u   100.2
 4   587.2  25.764u   748.3               17   7.848  1.1961u    92.0
 5   708.8  22.470u   617.2               18   9.820  1.2241u    62.5
 6   830.4  17.787u   566.3               19   12.43  265.60n   117.4
 7   1.010  14.187u   486.0               20   15.52  828.90n    38.0
 8   1.254  13.080u   365.7               21   19.49  78.500n   125.6
 9   1.498  12.048u   291.6               22   24.46  544.00n    23.6
10   1.741  10.083u   258.3               23   30.72  388.00n    20.3
11   2.153  7.0879u   232.5               24   38.66  273.30n    17.5
12   2.709  4.4288u   219.5               25   48.65  401.20n     9.2
13   3.308  3.5877u   182.5

Blk  Line a p  Station Freq Loop Cmp Stks Crnt Duty Window1 #W RxMoment Ts
AVG                -.5     4 INL  Hz            50%  222.4u     10000.0 28
Wn   Time     V/I  Variation  App_Res     Wn   Time     V/I  Variation  App_Res
 1   222.4  226.80u      1.    694.1      14   4.096  2.6955u     26.    155.8
 2   344.0  69.176u      2.    843.1      15   5.062  3.2827u     35.     96.5
 3   465.6  33.823u      6.    879.7      16   6.327  1.6901u     52.    104.2
 4   587.2  28.524u      9.    699.0      17   7.848  1.1812u     43.     92.7
 5   708.8  24.259u      6.    586.3      18   9.820  1.2151u     34.     62.8
 6   830.4  19.655u      8.    529.7      19   12.43  772.63n     70.     57.5
 7   1.010  16.262u     11.    443.6      20   15.52  455.57n     62.     56.7
 8   1.254  12.481u     15.    377.3      21   19.49  422.98n     60.     40.8
 9   1.498  11.634u     20.    298.5      22   24.46  261.32n     81.     38.6
10   1.741  9.5940u      7.    267.0      23   30.72  343.52n     16.     22.0
11   2.153  7.2584u      4.    228.8      24   38.66  204.93n     28.     21.2
12   2.709  5.2796u     26.    195.2      25   48.65  472.85n     11.      8.3
13   3.308  3.4862u     31.    186.0
```

*** end-of-file ***

Sample .RAW-file (partial: only data for Stn=0)

```
0269
TEM 0516 90-11-22 12:44:09 12.5v INL
OPER 7718 TX ID    3 A-SP  100.0
JOB 90001 LINE    1.0 N  SPREAD  1
 50% RxM 10000 TxX  193 TxY  193 #T  1
Tx Delay  155 Antenna Delay   15
1 LoPass  Notch 60,3-5,9  S/N  137 Passed
2 LoPass  Notch 60,3-5,9  S/N  129 Passed

0270
TEM 0516 90-11-22 12:48:36 12.5v INL
Tx      1 Rx      5 N OUT
   4 Hz    144 Cyc Tx Curr  5.00 486.4u 94u
1 Hz    -.5  0.4459u     16   259.1  065O 10.19u   -2.11     0
  Wn     Mag 1    Rho 1
 222.4u  225.45u  1.0662K
 344.0u  70.096u  1.1295K
 465.6u  33.845u  1.1107K
 587.2u  31.240u  795.27
 708.8u  24.114u  690.86
 830.4u  20.154u  598.09
 1.010m  18.306u  459.57
 1.254m  12.568u  412.24
 1.498m  13.411u  293.35
 1.741m  9.9031u  279.58
 2.153m  7.3451u  239.67
 2.709m  3.9551u  248.66
 3.308m  3.3547u  198.83
 4.096m  2.0712u  192.06
 5.062m  4.5280u  79.424
 6.327m  0.4459u  259.11
 7.848m  1.4370u  82.919
 9.820m  1.4384u  56.671
 12.43m  1.3582u  39.717
 15.52m  0.4975u  54.001
 19.49m  0.4328u  40.534
 24.46m  0.0512u  115.15
 30.72m  0.3753u  20.880
 38.66m  0.1311u  28.695
 48.65m  0.5010u  7.9299

0271
TEM 0516 90-11-22 12:49:40 12.5v INL
Tx      1 Rx      5 N OUT
   4 Hz    156 Cyc Tx Curr  5.00 486.4u 94u
1 Hz    -.5  2.0765u     16   92.35  065O 5.825u   -2.11     0
  Wn     Mag 1    Rho 1
 222.4u  228.99u  1.0551K
 344.0u  71.026u  1.1196K
 465.6u  35.428u  1.0771K
 587.2u  27.369u  869.14
 708.8u  26.057u  655.83
 830.4u  19.254u  616.73
 1.010m  15.451u  515.00
 1.254m  9.8338u  488.83
 1.498m  8.1882u  410.89
 1.741m  8.6694u  305.70
 2.153m  6.9393u  248.99
 2.709m  5.7130u  193.28
 3.308m  4.8226u  155.02
 4.096m  2.4943u  169.67
 5.062m  2.6761u  113.07
 6.327m  2.0765u  92.350
 7.848m  1.6276u  76.311
 9.820m  0.6250u  99.418
 12.43m  1.1016u  45.712
 15.52m  0.3215u  72.236
 19.49m  0.5023u  36.704
 24.46m  0.1619u  53.437
 30.72m  0.3485u  21.938
 38.66m  0.2073u  21.141
 48.65m  0.5196u  7.7376
```

*** continued ***

Sample .RAW-file (partial: page 2)

```
0271
TEM 0516 90-11-22 12:49:40 12.5v INL
Tx      1 Rx      5 N OUT
   4 Hz     156 Cyc Tx Curr  5.00 486.4u 94u
1 Hz    -.5  2.0765u     16   92.35  065O 5.825u   -2.11     0
  Wn      Mag 1    Rho 1
 222.4u  228.99u  1.0551K
 344.0u  71.026u  1.1196K
 465.6u  35.428u  1.0771K
 587.2u  27.369u  869.14
 708.8u  26.057u  655.83
 830.4u  19.254u  616.73
 1.010m  15.451u  515.00
 1.254m  9.8338u  488.83
 1.498m  8.1882u  410.89
 1.741m  8.6694u  305.70
 2.153m  6.9393u  248.99
 2.709m  5.7130u  193.28
 3.308m  4.8226u  155.02
 4.096m  2.4943u  169.67
 5.062m  2.6761u  113.07
 6.327m  2.0765u  92.350
 7.848m  1.6276u  76.311
 9.820m  0.6250u  99.418
 12.43m  1.1016u  45.712
 15.52m  0.3215u  72.236
 19.49m  0.5023u  36.704
 24.46m  0.1619u  53.437
 30.72m  0.3485u  21.938
 38.66m  0.2073u  21.141
 48.65m  0.5196u  7.7376

0272
TEM 0516 90-11-22 12:51:50 12.5v INL
Tx      1 Rx      5 N OUT
   4 Hz     256 Cyc Tx Curr  5.00 486.4u 94u
1 Hz    -.5  2.4477u     16   82.70  065O 6.024u   -2.11     0
  Wn      Mag 1    Rho 1
 222.4u  226.48u  1.0630K
 344.0u  67.617u  1.1573K
 465.6u  35.027u  1.0854K
 587.2u  29.722u  822.32
 708.8u  24.396u  685.50
 830.4u  21.425u  574.02
 1.010m  17.103u  481.05
 1.254m  14.444u  375.48
 1.498m  12.888u  301.29
 1.741m  9.7206u  283.09
 2.153m  7.6614u  232.99
 2.709m  7.0215u  168.28
 3.308m  2.1798u  265.04
 4.096m  2.5380u  167.72
 5.062m  3.9472u  87.104
 6.327m  2.4477u  82.703
 7.848m  0.4640u  176.18
 9.820m  1.5731u  53.367
 12.43m  0.3651u  96.052
 15.52m  0.1744u  108.60
 19.49m  0.6783u  29.862
 24.46m  0.2882u  36.389
 30.72m  0.2623u  26.513
 38.66m  0.2080u  21.096
 48.65m  0.4696u  8.2824
```

*** continued ***

Sample .RAW-file (partial: page 3)

```
0273
TEM 0516 90-11-22 12:53:16 12.5v INL
Tx      1 Rx      5 N OUT
   4 Hz     256 Cyc Tx Curr  5.00 486.4u 94u
1 Hz    -.5  1.7903u     16   102.6  065O 5.878u   -2.11     0
  Wn     Mag 1    Rho 1
 222.4u  226.26u  1.0637K
 344.0u  67.965u  1.1533K
 465.6u  30.991u  1.1783K
 587.2u  25.764u  905.12
 708.8u  22.470u  724.41
 830.4u  17.787u  650.42
 1.010m  14.187u  545.34
 1.254m  13.080u  401.34
 1.498m  12.048u  315.26
 1.741m  10.083u  276.23
 2.153m  7.0879u  245.48
 2.709m  4.4288u  230.59
 3.308m  3.5877u  190.13
 4.096m  3.6787u  130.08
 5.062m  1.9796u  139.10
 6.327m  1.7903u  102.57
 7.848m  1.1961u  93.710
 9.820m  1.2241u  63.510
 12.43m  0.2656u  118.74
 15.52m  0.8289u  38.422
 19.49m  0.0785u  126.54
 24.46m  0.5440u  23.679
 30.72m  0.3880u  20.420
 38.66m  0.2733u  17.586
 48.65m  0.4012u  9.2071
```

*** end-of-file ***

Sample .FLD-file (partial: only data for Stn= -0.5)
(columns 1-140 are followed columns 141-279, 279-421, and 422-467)

```
Reference ruler line                                                                                       1         1         1         1
----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+----0----+----1----+----2----+----3----

/* SHRED v3.20: "SAMTEM.FLD"
H 1 0269   1 0 TEM 0516 90-11-22 12:44:09 12.5 INL      7718    3  100.0 90001      1.0 N   1  50  10000  193  193  1  155e-6   15e-6
D 1 0270   1 0 90-11-22 12:48:36 12.5     4   144  5.00           1         5     Hz 0      -.5  0.4459e-6      16      259.1    0650
D 1 0271   1 0 90-11-22 12:49:40 12.5     4   156  5.00           1         5     Hz 0      -.5  2.0765e-6      16      92.35    0650
D 1 0272   1 0 90-11-22 12:51:50 12.5     4   256  5.00           1         5     Hz 0      -.5  2.4477e-6      16      82.70    0650
D 1 0273   1 0 90-11-22 12:53:16 12.5     4   256  5.00           1         5     Hz 0      -.5  1.7903e-6      16      102.6    0650
H 1 0269   2 1 TEM 0516 90-11-22 12:44:09 12.5 INL      7718    3  100.0 90001      1.0 N   1  50  10000  193  193  1  155e-6   15e-6
D 1 0274   2 1 90-11-22 12:58:00 12.5    16  1024  5.00           1         5     Hz 0      -.5  10.857e-6      16      310.7    0400
D 1 0275   2 1 90-11-22 13:00:53 12.5    16  1024  5.00           1         5     Hz 0      -.5  12.039e-6      16      289.9    0400
H 1 0269   3 2 TEM 0516 90-11-22 12:44:09 12.5 INL      7718    3  100.0 90001      1.0 N   1  50  10000  193  193  1  155e-6   15e-6
D 1 0276   3 2 90-11-22 13:05:52 12.5     4   256  5.00           2         5     Hz 0      -.5  3.9833e-6      16      59.62    0630
D 1 0277   3 2 90-11-22 13:07:19 12.5     4   256  5.00           2         5     Hz 0      -.5  3.8633e-6      16      60.86    0630
D 1 0278   3 2 90-11-22 13:09:25 12.5     4   256  5.00           2         5     Hz 0      -.5  3.3834e-6      16      66.54    0630


     1         1         1         1         1         1         2         2         2         2         2         2         2
+----4----+----5----+----6----+----7----+----8----+----9----+----0----+----1----+----2----+----3----+----4----+----5----+----6---

    1
10.19e-6   -2.11      0        1  486.4e-6   94e-6            222.4e-6 Tm  225.45e-6  70.096e-6  33.845e-6  31.240e-6  24.114e-6
5.825e-6   -2.11      0        1  486.4e-6   94e-6            222.4e-6 Tm  228.99e-6  71.026e-6  35.428e-6  27.369e-6  26.057e-6
6.024e-6   -2.11      0        1  486.4e-6   94e-6            222.4e-6 Tm  226.48e-6  67.617e-6  35.027e-6  29.722e-6  24.396e-6
5.878e-6   -2.11      0        1  486.4e-6   94e-6            222.4e-6 Tm  226.26e-6  67.965e-6  30.991e-6  25.764e-6  22.470e-6
    1
9.290e-6   -2.11      0        1  243.2e-6   24e-6            49.20e-6 Tm  31.633e-3  8.3669e-3  2.6368e-3  1.0708e-3  556.32e-6
5.019e-6   -2.11      0        1  243.2e-6   24e-6            49.20e-6 Tm  31.801e-3  8.4465e-3  2.6633e-3  1.0807e-3  554.68e-6
    1
19.72e-6    7.33      0        1  486.4e-6   94e-6            222.4e-6 Tm  433.88e-6  164.27e-6  82.515e-6  51.124e-6  35.426e-6
14.74e-6    7.33      0        1  486.4e-6   94e-6            222.4e-6 Tm  435.95e-6  172.37e-6  93.408e-6  57.068e-6  37.317e-6
12.90e-6    7.33      0        1  486.4e-6   94e-6            222.4e-6 Tm  438.69e-6  167.74e-6  90.219e-6  55.167e-6  38.776e-6


      2         2         2         3         3         3         3         3         3         3         3         3         3
-+----7----+----8----+----9----+----0----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8----+----9----+


  20.154e-6  18.306e-6  12.568e-6  13.411e-6  9.9031e-6  7.3451e-6  3.9551e-6  3.3547e-6  2.0712e-6  4.5280e-6  445.90e-9  1.4370e-6
  19.254e-6  15.451e-6  9.8338e-6  8.1882e-6  8.6694e-6  6.9393e-6  5.7130e-6  4.8226e-6  2.4943e-6  2.6761e-6  2.0765e-6  1.6276e-6
  21.425e-6  17.103e-6  14.444e-6  12.888e-6  9.7206e-6  7.6614e-6  7.0215e-6  2.1798e-6  2.5380e-6  3.9472e-6  2.4477e-6  464.00e-9
  17.787e-6  14.187e-6  13.080e-6  12.048e-6  10.083e-6  7.0879e-6  4.4288e-6  3.5877e-6  3.6787e-6  1.9796e-6  1.7903e-6  1.1961e-6

  338.35e-6  196.75e-6  108.94e-6  73.766e-6  55.186e-6  39.452e-6  29.675e-6  24.355e-6  18.791e-6  14.282e-6  10.857e-6  9.2921e-6
  340.40e-6  194.68e-6  108.73e-6  70.538e-6  53.304e-6  38.001e-6  27.965e-6  23.221e-6  18.355e-6  15.340e-6  12.039e-6  10.486e-6

  29.312e-6  18.931e-6  16.924e-6  10.689e-6  11.132e-6  10.550e-6  8.7713e-6  4.5849e-6  4.1788e-6  1.9088e-6  3.9833e-6  2.2485e-6
  31.820e-6  20.943e-6  18.619e-6  14.098e-6  11.516e-6  7.7475e-6  6.0881e-6  4.9224e-6  6.0040e-6  8.3265e-6  3.8633e-6  1.9163e-6
  25.674e-6  20.815e-6  14.512e-6  12.729e-6  12.058e-6  9.4502e-6  7.8697e-6  6.9024e-6  6.3508e-6  4.2198e-6  3.3834e-6  3.5993e-6


    4         4         4         4         4         4         4         4         4
----0----+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8---


  1.4384e-6  1.3582e-6  497.50e-9  432.80e-9  51.200e-9  375.30e-9  131.10e-9  501.00e-9
  625.00e-9  1.1016e-6  321.50e-9  502.30e-9  161.90e-9  348.50e-9  207.30e-9  519.60e-9
  1.5731e-6  365.10e-9  174.40e-9  678.30e-9  288.20e-9  262.30e-9  208.00e-9  469.60e-9
  1.2241e-6  265.60e-9  828.90e-9  78.500e-9  544.00e-9  388.00e-9  273.30e-9  401.20e-9

  9.1783e-6  7.6079e-6  5.3723e-6  5.5769e-6  4.2688e-6  3.0256e-6  3.1585e-6  2.9402e-6
  9.0467e-6  6.8593e-6  6.2314e-6  5.7057e-6  4.8234e-6  3.4712e-6  2.9062e-6  2.9305e-6

  1.9144e-6  3.6198e-6  2.9571e-6  3.7643e-6  3.2185e-6  2.5928e-6  2.3624e-6  1.8202e-6
  4.8965e-6  1.6892e-6  3.1724e-6  2.5743e-6  2.5576e-6  2.8928e-6  2.2987e-6  2.7883e-6
  3.3342e-6  2.6069e-6  3.0084e-6  2.5050e-6  2.5772e-6  2.0336e-6  2.4685e-6  2.6104e-6
```

*** end-of-file ***

Sample .AVG-file (partial: only data for Stn= -0.5)

```
\ TEMAVG 7.20: "SAMTEM.FLD", Dated 90-11-22, Processed 05 Aug 93
$ TEM: Array=In Loop (Central Loop)
$ TEM: TXramp= 155.0 us
$ TEM: TXdx=   633. ft
$ TEM: TXdy=   633. ft
$ TEM: TXarea= 37249 m^2
$ TEM: RXarea= 10000 m^2
skp Station  Freq Cmp Amps Win Time   Magnitude  RampAppRes    Depth     %Mag
\=][=======][====][=][====][=][=====][=========][=========][=========][=====]
 2     -0.50     4 Hz  5.00  1 0.2224  2.2679e+2  6.9407e+2  1.1413e+3    0.7
 2     -0.50     4 Hz  5.00  2 0.344   6.9176e+1  8.4314e+2  1.5645e+3    2.4
 2     -0.50     4 Hz  5.00  3 0.4656  3.3823e+1  8.7975e+2  1.8592e+3    5.9
 2     -0.50     4 Hz  5.00  4 0.5872  2.8524e+1  6.9905e+2  1.8612e+3    8.5
 2     -0.50     4 Hz  5.00  5 0.7088  2.4259e+1  5.8631e+2  1.8727e+3    6.1
 2     -0.50     4 Hz  5.00  6 0.8304  1.9655e+1  5.2969e+2  1.9266e+3    7.8
 2     -0.50     4 Hz  5.00  7 1.0105  1.6262e+1  4.4361e+2  1.9449e+3   11.1
 2     -0.50     4 Hz  5.00  8 1.2542  1.2481e+1  3.7729e+2  1.9983e+3   15.5
 2     -0.50     4 Hz  5.00  9 1.4978  1.1634e+1  2.9851e+2  1.9424e+3   20.3
 2     -0.50     4 Hz  5.00 10 1.7412  9.5940e+0  2.6702e+2  1.9808e+3    6.6
 2     -0.50     4 Hz  5.00 11 2.1527  7.2584e+0  2.2881e+2  2.0388e+3    4.4
 2     -0.50     4 Hz  5.00 12 2.7085  5.2796e+0  1.9520e+2  2.1123e+3   26.1
 2     -0.50     4 Hz  5.00 13 3.3083  3.4862e+0  1.8604e+2  2.2790e+3   31.1
 2     -0.50     4 Hz  5.00 14 4.0965  2.6955e+0  1.5580e+2  2.3207e+3   25.5
 2     -0.50     4 Hz  5.00 15 5.062   3.2827e+0  9.6484e+1  2.0302e+3   35.4
 2     -0.50     4 Hz  5.00 16 6.3267  1.6901e+0  1.0418e+2  2.3585e+3   51.6
 2     -0.50     4 Hz  5.00 17 7.8484  1.1812e+0  9.2748e+1  2.4785e+3   43.1
 2     -0.50     4 Hz  5.00 18 9.8203  1.2151e+0  6.2815e+1  2.2816e+3   34.5
 2     -0.50     4 Hz  5.00 19 12.431  7.7263e-1  5.7530e+1  2.4566e+3   69.9
 2     -0.50     4 Hz  5.00 20 15.517  4.5557e-1  5.6677e+1  2.7243e+3   61.8
 2     -0.50     4 Hz  5.00 21 19.487  4.2298e-1  4.0800e+1  2.5902e+3   59.5
 2     -0.50     4 Hz  5.00 22 24.463  2.6133e-1  3.8566e+1  2.8216e+3   81.1
 2     -0.50     4 Hz  5.00 23 30.716  3.4352e-1  2.1998e+1  2.3879e+3   16.5
 2     -0.50     4 Hz  5.00 24 38.656  2.0493e-1  2.1189e+1  2.6291e+3   28.4
 2     -0.50     4 Hz  5.00 25 48.648  4.7285e-1  8.2592e+0  1.8414e+3   11.0
$ TEM: Array=In Loop (Central Loop)
$ TEM: TXramp= 155.0 us
$ TEM: TXdx=   633. ft
$ TEM: TXdy=   633. ft
$ TEM: TXarea= 37249 m^2
$ TEM: RXarea= 10000 m^2
skp Station  Freq Cmp Amps Win Time   Magnitude  RampAppRes    Depth     %Mag
\=][=======][====][=][====][=][=====][=========][=========][=========][=====]
 2     -0.50    16 Hz  5.00  1 0.0492  3.1717e+4  1.3615e+2  2.3776e+2    0.4
 2     -0.50    16 Hz  5.00  2 0.0796  8.4067e+3  2.1114e+2  3.7661e+2    0.7
 2     -0.50    16 Hz  5.00  3 0.11    2.6500e+3  3.2202e+2  5.4674e+2    0.7
 2     -0.50    16 Hz  5.00  4 0.1404  1.0758e+3  4.4108e+2  7.2291e+2    0.7
 2     -0.50    16 Hz  5.00  5 0.1708  5.5550e+2  5.3745e+2  8.8015e+2    0.2
 2     -0.50    16 Hz  5.00  6 0.2012  3.3938e+2  6.0474e+2  1.0133e+3    0.4
 2     -0.50    16 Hz  5.00  7 0.2462  1.9571e+2  6.6788e+2  1.1780e+3    0.7
 2     -0.50    16 Hz  5.00  8 0.3072  1.0883e+2  7.2989e+2  1.3755e+3    0.1
 2     -0.50    16 Hz  5.00  9 0.368   7.2152e+1  7.4449e+2  1.5206e+3    3.2
 2     -0.50    16 Hz  5.00 10 0.4289  5.4245e+1  7.2285e+2  1.6175e+3    2.5
 2     -0.50    16 Hz  5.00 11 0.5318  3.8727e+1  6.6042e+2  1.7216e+3    2.6
 2     -0.50    16 Hz  5.00 12 0.6707  2.8820e+1  5.6814e+2  1.7933e+3    4.2
 2     -0.50    16 Hz  5.00 13 0.8207  2.3788e+1  4.7471e+2  1.8132e+3    3.4
 2     -0.50    16 Hz  5.00 14 1.0177  1.8573e+1  4.0135e+2  1.8566e+3    1.7
 2     -0.50    16 Hz  5.00 15 1.2591  1.4811e+1  3.3441e+2  1.8850e+3    5.1
 2     -0.50    16 Hz  5.00 16 1.5753  1.1448e+1  2.7843e+2  1.9239e+3    7.3
 2     -0.50    16 Hz  5.00 17 1.9557  9.8890e+0  2.1715e+2  1.8931e+3    8.5
 2     -0.50    16 Hz  5.00 18 2.4487  9.1125e+0  1.5955e+2  1.8158e+3    1.0
 2     -0.50    16 Hz  5.00 19 3.1013  7.2336e+0  1.2684e+2  1.8220e+3    7.3
 2     -0.50    16 Hz  5.00 20 3.8728  5.8019e+0  1.0227e+2  1.8283e+3   10.5
 2     -0.50    16 Hz  5.00 21 4.8653  5.6413e+0  7.1669e+1  1.7154e+3    1.6
 2     -0.50    16 Hz  5.00 22 6.1093  4.5461e+0  5.6923e+1  1.7131e+3    8.6
 2     -0.50    16 Hz  5.00 23 7.6726  3.2484e+0  4.8939e+1  1.7801e+3    9.7
 2     -0.50    16 Hz  5.00 24 9.6577  3.0324e+0  3.5017e+1  1.6893e+3    5.9
 2     -0.50    16 Hz  5.00 25 12.156  2.9353e+0  2.4437e+1  1.5833e+3    0.2
```

*** end-of-file ***

Sample .TEM-file (partial: only data thru CH11 included)

```
GDP AVERAGED TEM DATA   AMIRA FORMAT   For: ZONGE ENGINEERING
UNITS=(uV/A) RMP=0.1550 LSIDE=193 CHANNELFILE=SAMTEM.CHN INITDELAY=0.1550 RXAREA=10000 ARRAY=INL C=I FREQ=4HZ F=U LINE=5 JOB=9001
     STN  NCH     CH1        CH2        CH3        CH4        CH5        CH6        CH7        CH8        CH9       CH10       CH11
\ Project: TEM Sample Data
\ Date   : 90-11-22
\ Window Times:  0.2224     0.344      0.4656     0.5872     0.7088     0.8304     1.01046    1.25421    1.49775    1.74118    2.15274
    -0.50  25  2.2679e+2  6.9176e+1  3.3823e+1  2.8524e+1  2.4259e+1  1.9655e+1  1.6262e+1  1.2481e+1  1.1634e+1  9.5940e+0  7.2584e+0
    -0.50  25  4.3617e+2  1.6813e+2  8.8714e+1  5.4453e+1  3.7173e+1  2.8935e+1  2.0230e+1  1.6685e+1  1.2505e+1  1.1569e+1  9.2492e+0
     0.50  25  2.7570e+2  8.8921e+1  4.4917e+1  3.2276e+1  2.6129e+1  2.1605e+1  1.7708e+1  1.3426e+1  1.0348e+1  9.4983e+0  6.7407e+0
     0.50  25  5.1593e+2  1.9427e+2  9.6040e+1  5.6339e+1  3.8183e+1  2.7908e+1  2.1933e+1  1.5517e+1  1.4096e+1  1.1344e+1  9.3199e+0
     1.50  25  2.6841e+2  1.0769e+2  6.6238e+1  4.5953e+1  3.7141e+1  2.9648e+1  2.3411e+1  1.7881e+1  1.4314e+1  1.2172e+1  9.5072e+0
     1.50  25  4.9670e+2  2.1474e+2  1.1378e+2  7.1527e+1  4.7929e+1  3.5613e+1  2.6918e+1  2.0075e+1  1.5938e+1  1.4985e+1  1.0022e+1
     2.50  25  2.7268e+2  1.3885e+2  8.6836e+1  6.2521e+1  4.6031e+1  3.7953e+1  2.8012e+1  2.0194e+1  1.7839e+1  1.5763e+1  1.1624e+1
     2.50  25  5.0611e+2  2.3667e+2  1.3414e+2  8.6566e+1  5.9444e+1  4.4994e+1  3.0745e+1  2.3699e+1  1.7897e+1  1.4300e+1  1.1429e+1
     3.50  25  7.1471e+2  3.2738e+2  1.9862e+2  1.3644e+2  9.9344e+1  7.6325e+1  5.4243e+1  3.8576e+1  2.8359e+1  2.2143e+1  1.5808e+1
     3.50  25  9.6019e+2  4.4432e+2  2.5060e+2  1.5873e+2  1.0804e+2  8.0584e+1  5.5960e+1  3.8691e+1  2.9838e+1  2.4266e+1  1.6894e+1
     4.50  25  4.2069e+3  1.5124e+3  7.1602e+2  4.0178e+2  2.5161e+2  1.7325e+2  1.0907e+2  6.5576e+1  4.6753e+1  3.3949e+1  2.2885e+1
     4.50  25  4.5048e+3  1.6309e+3  7.6845e+2  4.2254e+2  2.6167e+2  1.7472e+2  1.1187e+2  6.5300e+1  4.4559e+1  3.0929e+1  1.9569e+1
************
GDP AVERAGED TEM DATA   AMIRA FORMAT   For: ZONGE ENGINEERING
UNITS=(uV/A) RMP=0.1550 LSIDE=193 CHANNELFILE=SAMTEM.CHN INITDELAY=0.1550 RXAREA=10000 ARRAY=INL C=I FREQ=16HZ F=U LINE=5 JOB=9001
     STN  NCH     CH1        CH2        CH3        CH4        CH5        CH6        CH7        CH8        CH9       CH10       CH11
\ Project: TEM Sample Data
\ Date   : 90-11-22
\ Window Times:  0.0492     0.0796     0.11       0.1404     0.1708     0.2012     0.24621    0.30715    0.36804    0.4289     0.53179
    -0.50  25  3.1717e+4  8.4067e+3  2.6500e+3  1.0758e+3  5.5550e+2  3.3938e+2  1.9571e+2  1.0883e+2  7.2152e+1  5.4245e+1  3.8727e+1
    -0.50  25  3.8031e+4  1.0163e+4  3.4218e+3  1.5636e+3  9.2421e+2  6.2805e+2  4.0933e+2  2.5388e+2  1.6851e+2  1.2129e+2  7.2618e+1
     0.50  25  3.7729e+4  1.0007e+4  3.1719e+3  1.3061e+3  6.9415e+2  4.3051e+2  2.5076e+2  1.3870e+2  8.7977e+1  6.4329e+1  4.0679e+1
     0.50  25  4.6263e+4  1.2466e+4  4.1550e+3  1.8834e+3  1.1118e+3  7.6108e+2  4.8896e+2  2.9873e+2  1.9807e+2  1.3520e+2  8.0822e+1
     1.50  25  4.3124e+4  1.1250e+4  3.2701e+3  1.2038e+3  5.9755e+2  3.7621e+2  2.3853e+2  1.5251e+2  1.1141e+2  8.5454e+1  5.7496e+1
     1.50  25  5.1344e+4  1.3738e+4  4.2202e+3  1.7548e+3  1.0030e+3  6.9237e+2  4.7285e+2  3.1365e+2  2.1376e+2  1.5954e+2  9.8361e+1
     2.50  25  2.7716e+4  7.9753e+3  2.4338e+3  1.0063e+3  5.6408e+2  3.8515e+2  2.6632e+2  1.8155e+2  1.3829e+2  1.0881e+2  7.6700e+1
     2.50  25  3.4165e+4  8.9304e+3  3.0321e+3  1.4481e+3  9.2272e+2  6.7564e+2  4.8313e+2  3.3328e+2  2.3893e+2  1.7524e+2  1.1413e+2
     3.50  25  4.9399e+4  1.5120e+4  5.4081e+3  2.5079e+3  1.4868e+3  1.0193e+3  6.8806e+2  4.5527e+2  3.3286e+2  2.5147e+2  1.7126e+2
     3.50  25  5.6119e+4  1.6861e+4  6.2492e+3  3.0559e+3  1.9038e+3  1.3688e+3  9.3764e+2  6.2948e+2  4.4992e+2  3.3394e+2  2.1482e+2
     4.50  25  1.0005e+5  4.8591e+4  2.5904e+4  1.5272e+4  9.8007e+3  6.6898e+3  4.1665e+3  2.4049e+3  1.5196e+3  1.0204e+3  5.8799e+2
     4.50  25  1.0900e+5  5.2429e+4  2.7707e+4  1.6279e+4  1.0437e+4  7.1212e+3  4.4548e+3  2.5924e+3  1.6365e+3  1.1022e+3  6.3099e+2
```

*** end of file ***

Sample .CHN-file

```
GDP Zonge delay times
NUMTIMES=25
DELAY
0.0492
0.0796
0.11
0.1404
0.1708
0.2012
0.24621
0.30715
0.36804
0.4289
0.53179
0.67073
0.82067
1.01772
1.2591
1.57527
1.95569
2.44868
3.10134
3.87284
4.86527
6.10926
7.67263
9.65767
12.15558
```

*** end of file ***

Sample .Z-file (partial: only data for Station= -0.5)

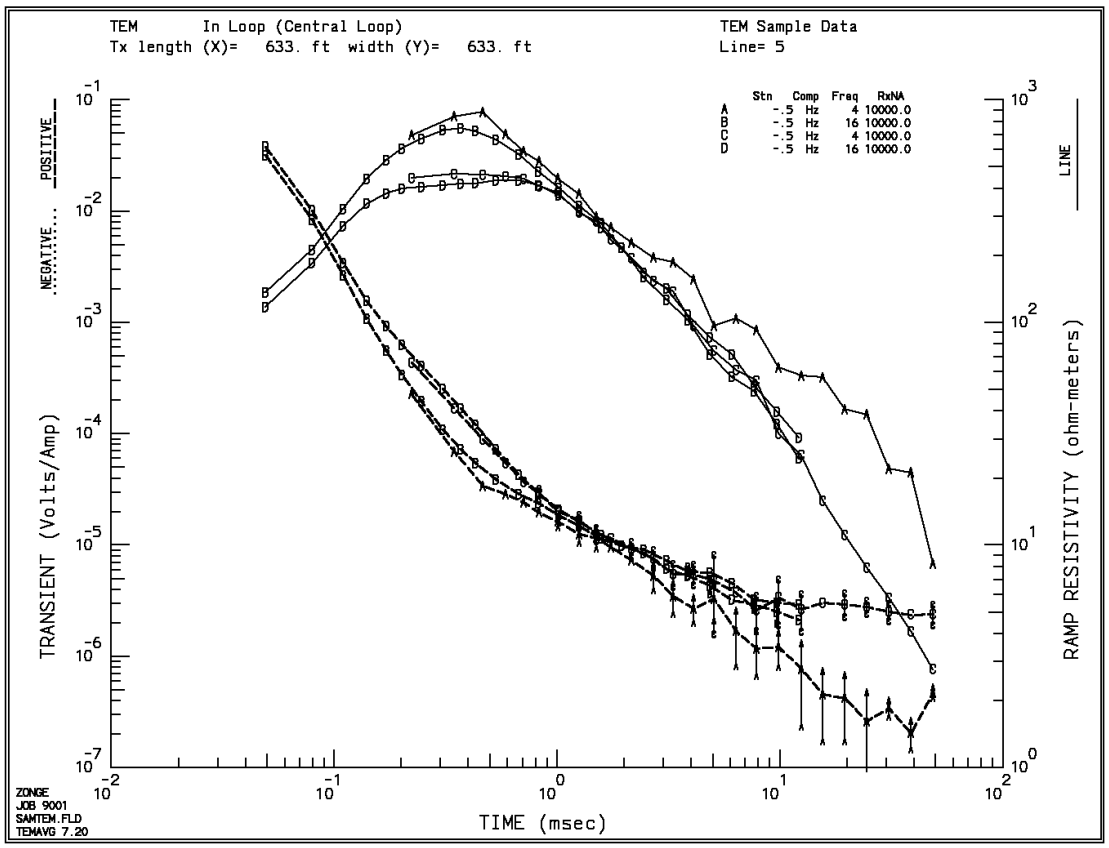
```
TEMAVG 7.20 Contour file.
/* 05 Aug 93
$ DATE= 90-11-22
$ ZPLOT: DATA= TIME
 Cl Cn Ce Ns Nd Yl   Plot file  1
  0  1  0  3  1  0
 TRANSIENT EM SURVEY DATA
 Window MAGNITUDE
    values in microV/ampere
    Component: Hz, Rxna:  10000.0
$ CONTOUR= NONE
$ PROFILE= AUTO
$ POST   = NONE
IIxxxxxxxxYYYYYYYYzzzzzzzzzzzz  AAA   ffffffffwwww
 2   -0.50 0.2224  2.26795e+02            4Hz W 1
 2   -0.50 0.344   6.91760e+01            4Hz W 2
 2   -0.50 0.4656  3.38227e+01            4Hz W 3
 2   -0.50 0.5872  2.85238e+01            4Hz W 4
 2   -0.50 0.7088  2.42593e+01            4Hz W 5
 2   -0.50 0.8304  1.96550e+01            4Hz W 6
 2   -0.50 1.01046 1.62617e+01            4Hz W 7
 2   -0.50 1.25421 1.24814e+01            4Hz W 8
 2   -0.50 1.49775 1.16338e+01            4Hz W 9
 2   -0.50 1.74118 9.59402e+00            4Hz W10
 2   -0.50 2.15274 7.25843e+00            4Hz W11
 2   -0.50 2.70852 5.27960e+00            4Hz W12
 2   -0.50 3.30826 3.48620e+00            4Hz W13
 2   -0.50 4.09646 2.69555e+00            4Hz W14
 2   -0.50 5.06202 3.28273e+00            4Hz W15
 2   -0.50 6.32667 1.69010e+00            4Hz W16
 2   -0.50 7.84838 1.18117e+00            4Hz W17
 2   -0.50 9.82033 1.21515e+00            4Hz W18
 2   -0.50 12.4309 7.72625e-01            4Hz W19
 2   -0.50 15.517  4.55575e-01            4Hz W20
 2   -0.50 19.4867 4.22975e-01            4Hz W21
 2   -0.50 24.4626 2.61325e-01            4Hz W22
 2   -0.50 30.7161 3.43525e-01            4Hz W23
 2   -0.50 38.6563 2.04925e-01            4Hz W24
 2   -0.50 48.6479 4.72850e-01            4Hz W25
 2   -0.50 0.2224  4.36173e+02            4Hz W 1
 2   -0.50 0.344   1.68127e+02            4Hz W 2
 2   -0.50 0.4656  8.87140e+01            4Hz W 3
 2   -0.50 0.5872  5.44530e+01            4Hz W 4
 2   -0.50 0.7088  3.71730e+01            4Hz W 5
 2   -0.50 0.8304  2.89353e+01            4Hz W 6
 2   -0.50 1.01046 2.02297e+01            4Hz W 7
 2   -0.50 1.25421 1.66850e+01            4Hz W 8
 2   -0.50 1.49775 1.25053e+01            4Hz W 9
 2   -0.50 1.74118 1.15687e+01            4Hz W10
 2   -0.50 2.15274 9.24923e+00            4Hz W11
 2   -0.50 2.70852 7.57637e+00            4Hz W12
 2   -0.50 3.30826 5.46990e+00            4Hz W13
 2   -0.50 4.09646 5.51120e+00            4Hz W14
 2   -0.50 5.06202 4.81837e+00            4Hz W15
 2   -0.50 6.32667 3.74333e+00            4Hz W16
 2   -0.50 7.84838 2.58803e+00            4Hz W17
 2   -0.50 9.82033 3.38170e+00            4Hz W18
 2   -0.50 12.4309 2.63863e+00            4Hz W19
 2   -0.50 15.517  3.04597e+00            4Hz W20
 2   -0.50 19.4867 2.94787e+00            4Hz W21
 2   -0.50 24.4626 2.78443e+00            4Hz W22
 2   -0.50 30.7161 2.50640e+00            4Hz W23
 2   -0.50 38.6563 2.37653e+00            4Hz W24
 2   -0.50 48.6479 2.40630e+00            4Hz W25
   :
   :
  9999.00
```

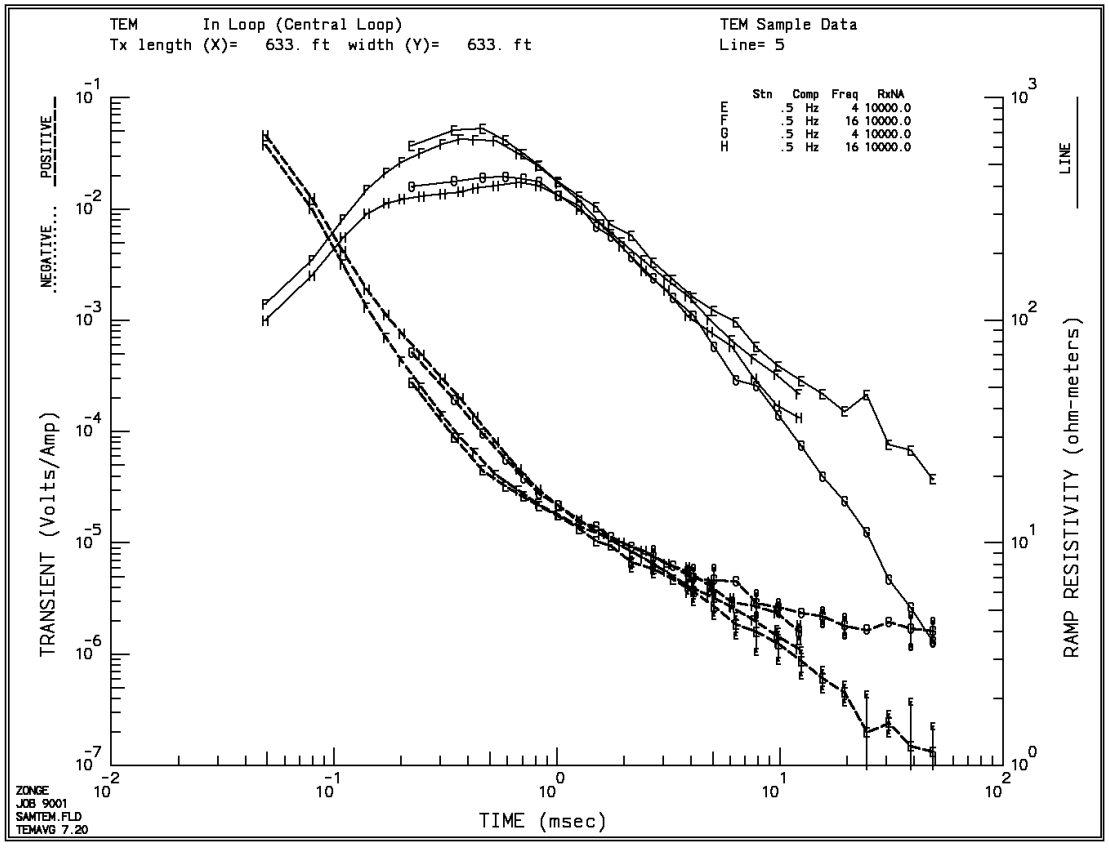
*** continued-next-column ***

```
 Cl Cn Ce Ns Nd Yl   Plot file  2
  0  1  0  3  1  0
 TRANSIENT EM SURVEY DATA
 Window MAGNITUDE
    values in microV/ampere
    Component: Hz, Rxna:  10000.0
$ CONTOUR= NONE
$ PROFILE= AUTO
$ POST   = NONE
IIxxxxxxxxYYYYYYYYzzzzzzzzzzzz  AAA   ffffffffwwww
 2   -0.50 0.0492  3.17170e+04            16Hz W 1
 2   -0.50 0.0796  8.40670e+03            16Hz W 2
 2   -0.50 0.11    2.65005e+03            16Hz W 3
 2   -0.50 0.1404  1.07575e+03            16Hz W 4
 2   -0.50 0.1708  5.55500e+02            16Hz W 5
 2   -0.50 0.2012  3.39375e+02            16Hz W 6
 2   -0.50 0.24621 1.95715e+02            16Hz W 7
 2   -0.50 0.30715 1.08835e+02            16Hz W 8
 2   -0.50 0.36804 7.21520e+01            16Hz W 9
 2   -0.50 0.4289  5.42450e+01            16Hz W10
 2   -0.50 0.53179 3.87265e+01            16Hz W11
 2   -0.50 0.67073 2.88200e+01            16Hz W12
 2   -0.50 0.82067 2.37880e+01            16Hz W13
 2   -0.50 1.01772 1.85730e+01            16Hz W14
 2   -0.50 1.2591  1.48110e+01            16Hz W15
 2   -0.50 1.57527 1.14480e+01            16Hz W16
 2   -0.50 1.95569 9.88905e+00            16Hz W17
 2   -0.50 2.44868 9.11250e+00            16Hz W18
 2   -0.50 3.10134 7.23360e+00            16Hz W19
 2   -0.50 3.87284 5.80185e+00            16Hz W20
 2   -0.50 4.86527 5.64130e+00            16Hz W21
 2   -0.50 6.10926 4.54610e+00            16Hz W22
 2   -0.50 7.67263 3.24840e+00            16Hz W23
 2   -0.50 9.65767 3.03235e+00            16Hz W24
 2   -0.50 12.1556 2.93535e+00            16Hz W25
 2   -0.50 0.0492  3.80305e+04            16Hz W 1
 2   -0.50 0.0796  1.01630e+04            16Hz W 2
 2   -0.50 0.11    3.42175e+03            16Hz W 3
 2   -0.50 0.1404  1.56360e+03            16Hz W 4
 2   -0.50 0.1708  9.24210e+02            16Hz W 5
 2   -0.50 0.2012  6.28045e+02            16Hz W 6
 2   -0.50 0.24621 4.09330e+02            16Hz W 7
 2   -0.50 0.30715 2.53875e+02            16Hz W 8
 2   -0.50 0.36804 1.68505e+02            16Hz W 9
 2   -0.50 0.4289  1.21290e+02            16Hz W10
 2   -0.50 0.53179 7.26175e+01            16Hz W11
 2   -0.50 0.67073 4.28385e+01            16Hz W12
 2   -0.50 0.82067 2.93975e+01            16Hz W13
 2   -0.50 1.01772 2.07790e+01            16Hz W14
 2   -0.50 1.2591  1.61220e+01            16Hz W15
 2   -0.50 1.57527 1.23120e+01            16Hz W16
 2   -0.50 1.95569 9.85670e+00            16Hz W17
 2   -0.50 2.44868 8.48615e+00            16Hz W18
 2   -0.50 3.10134 6.12165e+00            16Hz W19
 2   -0.50 3.87284 5.33135e+00            16Hz W20
 2   -0.50 4.86527 4.29420e+00            16Hz W21
 2   -0.50 6.10926 3.22460e+00            16Hz W22
 2   -0.50 7.67263 2.95315e+00            16Hz W23
 2   -0.50 9.65767 2.50530e+00            16Hz W24
 2   -0.50 12.1556 2.12995e+00            16Hz W25
   :
   :
  9999.00
```

*** end-of-file ***

Sample .Xnn-file Graphics Plot file (two of six plots)





Appendix C ... FILE DOCUMENTATION

.AVG-file Format (v1.0) CSAMT Averaged Data File

The .AVG-file is defined by the order of data on each line, not by character positions as is typical with other data file formats. The first line is expected to be a list of column titles, with at least one space between each title. The title line is followed by lines of data values, one value for each title provided and in the same order, and with at least one space between values. If no value is available, then an asterix (*) is used. Data may be aligned in columns, but it is not required. Comment lines may occur anywhere in the file, each beginning with the characters (/*) or (\) in the first column.

```
\ TEMAVG 7.20: "SAMTEM.FLD", Dated 90-11-22, Processed 05 Aug 93
$ TEM: Array=In Loop (Central Loop)
$ TEM: TXramp= 155.0 us
$ TEM: TXdx=   633. ft
$ TEM: TXdy=   633. ft
$ TEM: TXarea= 37249 m^2
$ TEM: RXarea= 10000 m^2
skp Station  Freq Cmp Amps Win Time   Magnitude  RampAppRes    Depth     %Mag
\=][=======][====][=][====][=][=====][=========][=========][=========][=====]
 2     -0.50     4 Hz  5.00  1 0.2224  2.2679e+2  6.9407e+2  1.1413e+3    0.7
 2     -0.50     4 Hz  5.00  2 0.344   6.9176e+1  8.4314e+2  1.5645e+3    2.4
 2     -0.50     4 Hz  5.00  3 0.4656  3.3823e+1  8.7975e+2  1.8592e+3    5.9
 2     -0.50     4 Hz  5.00  4 0.5872  2.8524e+1  6.9905e+2  1.8612e+3    8.5
 2     -0.50     4 Hz  5.00  5 0.7088  2.4259e+1  5.8631e+2  1.8727e+3    6.1
 2     -0.50     4 Hz  5.00  6 0.8304  1.9655e+1  5.2969e+2  1.9266e+3    7.8
 2     -0.50     4 Hz  5.00  7 1.0105  1.6262e+1  4.4361e+2  1.9449e+3   11.1
 2     -0.50     4 Hz  5.00  8 1.2542  1.2481e+1  3.7729e+2  1.9983e+3   15.5
 2     -0.50     4 Hz  5.00  9 1.4978  1.1634e+1  2.9851e+2  1.9424e+3   20.3
 2     -0.50     4 Hz  5.00 10 1.7412  9.5940e+0  2.6702e+2  1.9808e+3    6.6
 2     -0.50     4 Hz  5.00 11 2.1527  7.2584e+0  2.2881e+2  2.0388e+3    4.4
 2     -0.50     4 Hz  5.00 12 2.7085  5.2796e+0  1.9520e+2  2.1123e+3   26.1
 2     -0.50     4 Hz  5.00 13 3.3083  3.4862e+0  1.8604e+2  2.2790e+3   31.1
 2     -0.50     4 Hz  5.00 14 4.0965  2.6955e+0  1.5580e+2  2.3207e+3   25.5
 2     -0.50     4 Hz  5.00 15 5.062   3.2827e+0  9.6484e+1  2.0302e+3   35.4
 2     -0.50     4 Hz  5.00 16 6.3267  1.6901e+0  1.0418e+2  2.3585e+3   51.6
 2     -0.50     4 Hz  5.00 17 7.8484  1.1812e+0  9.2748e+1  2.4785e+3   43.1
 2     -0.50     4 Hz  5.00 18 9.8203  1.2151e+0  6.2815e+1  2.2816e+3   34.5
 2     -0.50     4 Hz  5.00 19 12.431  7.7263e-1  5.7530e+1  2.4566e+3   69.9
 2     -0.50     4 Hz  5.00 20 15.517  4.5557e-1  5.6677e+1  2.7243e+3   61.8
 2     -0.50     4 Hz  5.00 21 19.487  4.2298e-1  4.0800e+1  2.5902e+3   59.5
 2     -0.50     4 Hz  5.00 22 24.463  2.6133e-1  3.8566e+1  2.8216e+3   81.1
 2     -0.50     4 Hz  5.00 23 30.716  3.4352e-1  2.1998e+1  2.3879e+3   16.5
 2     -0.50     4 Hz  5.00 24 38.656  2.0493e-1  2.1189e+1  2.6291e+3   28.4
 2     -0.50     4 Hz  5.00 25 48.648  4.7285e-1  8.2592e+0  1.8414e+3   11.0
```

Skp
skip flag (0:skip, 2:use)

Station
Receiver Station location

Freq
Repetition-rate during measurement (hertz)
Data file is sorted by frequency and component

Cmp
Component, such as H-field Z-component (uV/Amp)
Data file is sorted by frequency and component.

Amps
Average SquareWave transmitted current (Amps)

Win
Window number

Time
Window Center Time (milliSeconds)

Magnitude
Magnitude of the signal measured at the specified window. (microVolts/Amp)

NormCOLRes
Calculated Resistivity value (Ohm-Meters)
COL = Coincident Loop configuration
INL = In-Loop configuration
FXL = Fixed-loop configuration
MVL = Moving Loop configuration

Depth
Depth of investigation, calculated from Resistivity (Ohm-Meters) and Time (milliSeconds):

Depth = 28 * sqrt(Resistivity * Time)

Values are provided only for In-Loop array configurations. Units are the same as used for the loop dimensions in the header.

%Mag
Statistical variation of data block magnitude values.

.TEM-File Format Notes

The AMIRA TEM file is in a format agreed upon by AMIRA sponsors of the TEM Software Engineering Project. It is the format for TEM response data which is used by the SUITE software, the result of the project. (The SIROEX program)

The Geosoft file format is used as the basis of the AMIRA format. It is described in detail in an article by Reeves and MacLeod in First Break vol 4, no. 2, pp 9-17 (1986). The AMIRA extensions and limitations are specified in a paper by Neil Flood: CSIRO EM Modeling Suite, TEM Data File Format, January 1990.

This is a generic file format, falling into the general category for self-defining formats. This means that the detail of a given file is described by a header, allowing different files to contain different types of data. It is suitable for data which can be represented as columns of information, which are separated by spaces. Character data can be included in these columns, but character strings cannot contain spaces. There is no provision for character strings in quotes or similar. Thus it is generally intended for numeric data, with only limited character data.

The AMIRA file format is a particular case of the general Geosoft file format. It contains three lines at the top for header, and columns of data underneath.

The first line of the header provides a single line title for the file.

The second line is used for constants. These are single values associated with the data and take the form name:value or name=value with spaces separating each constant from the next.

The third line is used for column headings, also referred to as labels. These are single words associated with the columns of data.

Each line below the first three is used for data, until the end of the file. There is no such thing as a blank column.

The AMIRA format also includes a comment capability. A comment is a line with a \ as the very first character. The entire line will be ignored. Comment lines may appear anywhere in the file.

.CHN-File Format Notes

The .CHN-file provides users of the AMIRA format file with a list of times used at various windows, when using an instrument (such as a Zonge GDP) whose window times need to be specified independently. The AMIRA parameter CHANNELFILE specifies the .CHN-filename.

.Z-file Format (v2.0) Plot File For All Data

```
 1: $ ZPLOT: DATA= FLOG
 2: /* 29 Jul 93
 3:  AMTAVG 7.20 Contour file.
 4:  Cl Cn Ce Ns Nd Yl   Plot file  1
 5:   1  5  0  3  1  1
 6:  CSAMT SURVEY DATA
 7:  CAGNIARD RESISTIVITY
 8:   values in ohm-meters
 9: IIxxxxxxxxYYYYYYYYzzzzzzzzzzz  AAA
    2     0.0   22.00   2.719E+02
    2     0.0   21.00   2.365E+02
    2     0.0   20.00   2.221E+02
    2     0.0   19.00   1.937E+02
    2     0.0   18.00   1.644E+02
    :      :      :         :
99: 9999.00
```

DESCRIPTION OF VALUES IN SAMPLE FILE BY LINE NUMBER:

Line # Explanation:

2: **$ ZPLOT: DATA= FLOG** Mode line, Y-value data type (log Freq)

3: **AMTAVG 7.20** Program name and version that generated this file.

4: **Cl** Label for contour type: 0 = linear
1 = logarithmic
2 = pseudo-log
Pseudo-log contours: positive and negative values contoured separately, using $\log_{10}$(abs(value)), plus a zero contour.
Cn Label for number of contours per interval.
Ce Label for exponent of the contour interval.
The "interval" is an integer power of ten: 10^{Ce}
Ns Label for number of significant digits when posting values.
Values: -1, 3, 4, 5. (-1 = free format for small values)
Nd Label for the number of digits after the decimal.
Yl Label for vertical axis: 0 = none
1 = linear frequency (log spacing)
2 = log frequency (linear spacing)
3 = linear depth

5: **1** Value of Cl: logarithmic contours
5 Value of Cn: 5 contours per "interval"
0 Value of Ce: interval = $10^0 = 1$
3 Value of Ns: use 3 significant digits for contouring
1 Value of Nd: plot 1 digit after the decimal
1 Value of Yl: linear frequency axis (log spacing of freqs)

6-8: Data description for this Plot File. Two to six lines are available, NOT including the first column. Plot programs may plot these lines as title information.

9: Header line for the data that follows:

II - Command flag:

0 = Skip this line of data.
1 = Omit for contouring, but post the bracketed value.
2 = Use for contouring and post the value (most common).
3 = Label a point or station by plotting a symbol under the X-axis at the X-coordinate.
4 = Use for contouring, post the symbol and not the value.
Used for depth plots where values are interpolated for the bottom of the plot to improve the gridding.
5 = Use to set plot limits, do not contour or post.
Used for depth plots to set zero depth. Used to provide a margin around the data, as for plan maps.

xxxxxxxx - X-coordinate, usually station coordinate.

YYYYYYYY - Y-coordinate, not used for Flag = 3

zzzzzzzz - Value to be plotted at X-Y for Flags 1, 2, 4.

AAA - For Flag 1 or 2, ZPLOT posts any characters in the AAA column instead of the value in the **zzzzzzzz** column.

For Flag 3, ZPLOT plots a symbol below the X-axis at the x-value, according to an integer in column AAA. A zero or positive integer refers to symbols in TABLE 1 of the PLOT Manual. A negative integer refers to topographic symbols in the CTOPO Manual.

99: **9999.0** - End-Of-Plot indicator.

Transient ElectroMagnetic data append profile plot data. Points at a single time (Y) for one frequency (f) and window (w) are connected from station to station by a profile line.

YYYYYYYY - Time in milliseconds for a particular window.
ffffffff - Frequency at which data was acquired.
wwww - Window number.

```
IIxxxxxxxxYYYYYYYYzzzzzzzzzzzz  AAA   ffffffffwwww
 2  100.00   0.121-9.10488E+02          *32* Hz W 1
 2  100.00   0.243-1.34988E+03          *32* Hz W 2
 2  100.00   0.364-3.91872E+02          *32* Hz W 3
```