

**AMTAVG  
DOCUMENTATION**

**ZONGE Data Processing  
CSAMT Data Averaging Program**

version 7.2x

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December, 1996

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## AMTAVG Program Documentation

### OVERVIEW

AMTAVG averages GDP CSAMT (CSAM) and Harmonic CSAMT (CSHA) raw data. Several files may be created, including a log file (.LOG-file), listing file (.AL-file), average data files (.AD- and .AVG-file), plot file (.Z-file), and vector files (.Xnn-files).

### INPUT FILES

AMTAVG 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 CSAMT data, one record contains data measured by two channels, one that measured an E-field component and a second that measured an orthogonal H-field component, such as Ex and Hy components. 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 AMTAVG, 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 AMTAVG.

### OUTPUT FILES

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

The listing file (.AL-file) presents raw and 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 AMTAVG 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. AMTAVG includes sections for Resistivity and Impedance Phase data in the .Z-file.

The average file (.AD-file) includes averaged E- and H-field component data, organized by station and sorted by frequency. This format is expected for input to older versions of the AMTRED and AMTPLT programs, in addition to some ZONGE modeling programs.

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 versions of the AMTRED and AMTPLT programs, in addition to several utility routines and some ZONGE modeling programs. The format is also suitable for use by spreadsheet, database, and plot programs.

Log-log plots of Resistivity, E- or H-field Magnitude versus Frequency, including block-average error bars, are available on the computer screen. They may be printed on paper by using the FPLOTT utility program to rasterize the plot files (.Xnn-files).

### **SURVEY LOCATION CONVENTIONS**

Zonge DATPRO programs assume that the GDP operator enters CSAMT survey locations 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.

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.

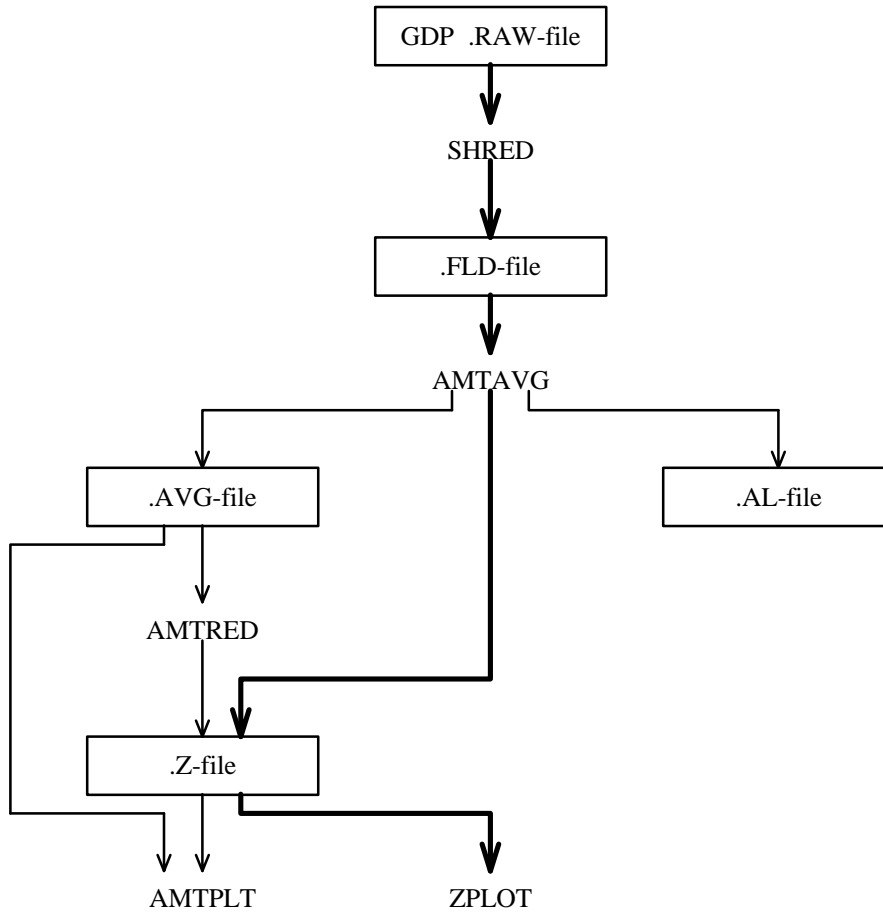
CSAMT DATA PROCESSING FLOW

August, 1993

Program names are CAPITALIZED

File types are boxed

Thick lines show standard GDP data processing.



Other files read or written:

.MDE-file

.LOG-file

.Xnn-file

**AMTAVG Usage**

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

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

Several variable parameters called "MODES" influence the operation of AMTAVG. 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 AMTAVG.

**AMTAVG MODE DISPLAY**

PROCESSING MODES USED:

CONTROL MODES mode names mode values	AutoRun AUTO NO	AvgMethod CALC RECT	HarmLimit HARMONIC NONE	PhaseRef PHASEREF NO	Current NORMAL 1.0	
OUTPUT FILES mode names mode values	ListFile LFILE NONE	AvgFile DFILE ExHy	PlotFile ZFILE ExHy	StnSort SORT YES	StnLabel LABEL	
PLOT LIMITS mode names mode values	DataType PLOT NONE	MagLoLim VMIN AUTO	MagHiLim VMAX AUTO	FrqLoLim FMIN AUTO	FrqHiLim FMAX AUTO	
PLOT MODES mode names mode values	Spline SPLINE LINEAR	Spline NUMCURVES 7	LblSort LMAG READ	LblSort ERRORBARS YES	Preview VIEW NONE	

**AMTAVG ERROR MESSAGES**

If errors or inconsistencies (primarily within the .FLD-file) arise within the program, AMTAVG 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.



## AMTAVG OUTPUT SELECTIONS

AMTAVG may write a "listing" (.AL-file), average data (.AVG- and .AD-files), a plot data (.Z-file), log-log plots with error bars (.Xnn-files), or a screen display of the station curves as they are created (see mode "VIEW"). An .AVG-, .AD-, and .Z-file are automatically created by AMTAVG with the default values for the mode variables "DFILE" and "ZFILE". Mode "LFILE" may be used to select a listing .AL-file.

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

"PLOT= RHO"     plots log-Resistivity versus log-Frequency  
"PLOT= EMAG"    plots log-E-field Magnitude versus log-Frequency  
"PLOT= HMAG"    plots log-H-field Magnitude versus log-Frequency

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

The .Z-file written by AMTAVG contains the same Resistivity and Impedance-Phase values obtained by running AMTRED to produce .Z-files. The Y-values in an AMTAVG .Z-file are restricted to log-base-2 of Frequency values. Linear Depth Y-axes are available through the AMTRED program.

**AMTAVG Sample Run**

Input files: SAMCSAM.FLD SAMCSAM.MDE  
 Output files: SAMCSAM.LOG SAMCSAM.AL log and listing files  
 SAMCSAM.AD SAMCSAM.AVG average data files  
 SAMCSAM.Z SAMCSAM.Xnn XYZ and plot files

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

C:> **AMTAVG SAMCSAM** Start program, specify data file

ZONGE ENGINEERING: 3322 E. Fort Lowell, Tucson AZ 85716, USA  
 AMTAVG 7.20: CSAMT FIELD DATA average program  
 MS-DOS version implemented 01 August, 1993.

MODE CLIENT=ZONGE ENGINEERING **\*\*\* entries from .MDE-file \*\*\***  
 MODE PROJECT=Sample Data  
 :  
 :  
 MODE RX2TX=North  
 MODE RXBRG=N 90 E

(Type MENU for assistance with MODEs.)

MODE Change [name?, name= value] : **PLOT= Rho** **\*\*\* Enable Plots**  
 MODE Change [name?, name= value] : **<RETURN>** **\*\*\* Continue**

Files used: "SAMCSAM.FLD", and "SAMCSAM.MDE"

Initializing for .AD-file . . .

Station " 0.0" (ExHy), line 26, 10 freqs: Data DONE  
 Station " 6.0" (ExHy), line 49, 10 freqs: Data DONE  
 Station " 12.0" (ExHy), line 75, 10 freqs: Data DONE

File: "SAMCSAM.X01" 5344 bytes, ready for rasterizing.  
 Station " 18.0" (ExHy), line 101, 10 freqs: Data DONE  
 Station " 24.0" (ExHy), line 132, 10 freqs: Data DONE  
 Station " 30.0" (ExHy), line 167, 10 freqs: Data DONE

File: "SAMCSAM.X02" 5471 bytes, ready for rasterizing.  
 Station " 36.0" (ExHy), line 204, 10 freqs: Data DONE  
 Station " 42.0" (ExHy), line 237, 10 freqs: Data DONE  
 Station " 48.0" (ExHy), line 260, 10 freqs: Data DONE

File: "SAMCSAM.X03" 5358 bytes, ready for rasterizing.  
 Completing output data files . . .

Plot file # 1 for: Cagniard Resistivity  
 Plot file # 2 for: Impedance Phase  
 File "SAMCSAM.AVG" contains averaged data for 9 stations.

Files ready for rasterizing:  
 SAMCSAM.X01 thru SAMCSAM.X03

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 <CTRL><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	FLOW	(not yet)	GORX	GORY
mode values	NO	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.

**AMTAVG MODE LIST**

(v 7.2x)

PROCESSING MODE DEFAULT VALUES:

CONTROL MODES mode names mode values	AutoRun AUTO NO	AvgMethod CALC RECT	HarmLimit HARMONIC NONE	PhaseRef PHASEREF NO	Current NORMAL 1.0	
OUTPUT FILES mode names mode values	ListFile LFILE NONE	AvgFile DFILE ExHy	PlotFile ZFILE ExHy	StnSort SORT YES	StnLabel LABEL	
PLOT LIMITS mode names mode values	DataType PLOT NONE	MagLoLim VMIN AUTO	MagHiLim VMAX AUTO	FrqLoLim FMIN AUTO	FrqHiLim FMAX AUTO	
PLOT MODES mode names mode values	Spline SPLINE LINEAR	Spline NUMCURVES 7	LblSort LMAG READ	LblSort ERRORBARS YES	Preview VIEW NONE	

**COMPANY**

Company name

Values: COMPANY= Name of survey company

(40 chr max)

Default: COMPANY= (blank)

**CLIENT**

Client name

Values: CLIENT= Company requesting the survey

(40 chr max)

Default: CLIENT= (blank)

**PROJECT**

Project name

Values: PROJECT= Name of the survey project.

(40 chr max)

Default: PROJECT= (blank)

**JOBNUMBER**

Company job number

Values: JOBNUMBER= Survey Job Number.

(10 chr max)

Default: JOBNUMBER= (blank)

**JOBDATE**

Survey date

Values: JOBDATE= Date of Survey.

(10 chr max)

Default: JOBDATE= (blank)

**JOBLINE**

Survey line number

Values: JOBLINE= Survey Line Number.

(10 chr max)

Default: JOBLINE= (blank)

**BRGLINE**

Line forward bearing

Values: BRGLINE= Line Bearing, to high stn.

(10 chr max)

Default: BRGLINE= (blank)

**BRGBACK**

Line back bearing

Values: BRGBACK= Back Bearing, to low stn.

(10 chr max)

Default: BRGBACK= (blank)

**STNLO**

Low station number, plot limit

Values: STNLO= X-axis low station limit.

Default: STNLO= NONE

**STNHI**

High station number, plot limit

Values: STNHI= X-axis high station limit.

Default: STNHI= NONE

**STNDELTA**

Station number increment, plot scale

Values: STNDELTA= X-axis station increment.

Default: STNDELTA= 1.0

**LBLFRST**

Low station number, axis label

Values: LBLFRST= X-axis low station label.

Default: LBLFRST= mode STNLOW value.

**LBLDELTA**

Station number increment, axis label

Values: LBLDELTA= X-axis station label increment.

Default: LBLDELTA= 1.0

**FRQLO**

Low frequency, plot limit

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

Default: FRQLO= NONE

**FRQHI**

High frequency, plot limit

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

Default: FRQHI= NONE

**TXLEN**

CSAMT Transmitter length

Values: TXLEN= CSAMT Transmitter Length (10 chr max)  
Default: TXLEN= (blank)

**TXBRG**

CSAMT Transmitter bearing

Values: TXBRG= CSAMT Transmitter Bearing (10 chr max)  
Default: TXBRG= (blank)

**TXDIS**

CSAMT Transmitter distance from survey line

Values: TXDIS= Distance from Rx Line to Tx (10 chr max)  
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 will be done as specified by entries in the .MDE-file (modes PLOT and VIEW).

Values: AUTO= No, or Yes.

Default: AUTO= No

**CALC**

RHO and PD values at a frequency are calculated by averaging the values at each block (PARAMETRIC), and averaging the E-and H-field COMPONENTS and calculating the values from the results. COMPONENT averages are written to data files.

The mode CALC specifies whether to average Magnitude and Phase values, or to convert to Real and Quadrature components for averaging. At this time, statistics are calculated using the Magnitude and Phase values.

Values: CALC= Polar (No), or Rectangular (Yes)

Default: CALC= Rectangular

**HARMONIC**

Limit the maximum harmonic to be processed by setting mode HARMONIC. Any value other than 1, 3, 5, or 7 will be set to 9 (displayed in the mode list as NONE).

Values: HARMONIC= NONE, 1, 3, 5, 7, or 9.

Default: HARMONIC= NONE (same as HARMONIC= 9)

**PHASEREF**

Mode PHASEREF enables "Phase Reference". Any phase value provides a list of possible, valid values, each differing by  $2 \cdot \pi$ . The set of values can be described by  $V + N \cdot \pi$ , where V is the phase value, and N is any positive or negative integer. "Phase Reference" attempts to reduce this ambiguity.

During averaging, phase values will be reduced as close to zero as possible by adding or subtracting by  $2 \cdot \pi$ . The results are averaged.

Phase values will be displayed and written to data files by using the low frequency value at each station as an initial reference. The value at the next higher frequency is adjusted by  $2 \cdot \pi$  so that the closest value to the reference is selected. This value then becomes the reference value for adjusting the value at the next higher frequency.

Values: PHASEREF= No, or Yes.

Default: PHASEREF= No



**NORMAL**

E- and H-field magnitudes are normalized by dividing by the data block current, and multiplying by the NORMAL current. When NORMAL= FIX, the low frequency current for the FIRST station is the NORMAL current for ALL stations. When NORMAL= STN, the low frequency current for EACH station is used for THAT station. When NORMAL= value, that constant is used for ALL stations.

Values: NORMAL= FIX, STN, or value (constant normalizing current)  
Default: NORMAL= 1.00 amps

**LFILE**

A summary listing (.AL-file) may be written, suitable for printing. LFILE specifies whether or not to write the summary file.

Values: LFILE= None (No), or AL-file (Yes)  
Default: LFILE= No

**DFILE**

The averaged component data may be written to an .AD-file for use by additional programs. E- and H-field values for magnitude and phase are written. Mode DFILE specifies whether or not to write the file.

If Mode DFILE and ZFILE are enabled, the same data must be selected.

Values: DFILE= None (No), ExHy (Yes)(AD), EyHx, or E-Hz.  
Default: DFILE= ExHy

**ZFILE**

The averaged resistivity and impedance-phase data may be written to a .Z-file for direct use by plot programs. Mode ZFILE specifies which component pair, if any, to include in the .Z-file.

If Mode DFILE and ZFILE are enabled, the same data must be selected.

Values: ZFILE= None (No), ExHy (Yes)(Z), EyHx, or E-Hz.  
Default: ZFILE= ExHy

**SORT**

The averaged data written to .AD- and/or .Z-files (as selected) may be written in the order provided by the input .FLD-file, or the data may be sorted by station number. The sort is a numeric sort, since the program manipulates station numbers numerically.

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

**LABEL**

Output file labels normally use the input file values. Use mode LABEL to replace input file values with another label, which may be alphanumeric, up to eight characters in length.

Do not set this mode at either the MODE: prompt or in a .MDE-file, as it will apply to just the first station. Enter \$ LABEL= label in the input file, AFTER the first block of the station, using one entry for each station (in general, modes are part of the preceding data block!). The LABEL will be reset to blanks after it has been used. The input file value will be used when LABEL is blank.

Values: LABEL= station label, 8 characters max. (only in data file)  
Default: LABEL= (blank)

**PLOT**

Log-log plots of data for each station may be plotted to a raster file. Mode PLOT specifies which data to plot. RHO, E-MAG, or H-MAG plots are available. All plots may include error bars.

Mode NUMCURVES specifies the number of curves per plot.

Mode ERRORBARS selects plots with errorbars.

Mode VIEW enables plot preview on screen.

Values: PLOT= None (No), RHO (Yes), EMAG, or HMAG.

Default: PLOT= No

**VMIN**

Mode VMIN specifies the bottom border of plots. When VMIN= AUTO, the minimum for the FIRST station of each plot will be used.

Plot limits are presently restricted to decade boundaries. The value specified will be shifted to the next lower decade.

Related modes: VMIN, VMAX, FMIN, FMAX.

Values: VMIN= AUTO or low magnitude limit

Default: VMIN= AUTO

**VMAX**

Mode VMAX specifies the top border of plots. When VMAX= AUTO, the maximum for the FIRST station of each plot will be used.

Plot limits are presently restricted to decade boundaries.

The value specified will be shifted to the next higher decade.

Related modes: VMIN, VMAX, FMIN, FMAX.

Values: VMAX= AUTO or high magnitude limit

Default: VMAX= AUTO

**FMIN**

Mode FMIN specifies the left border of plots. When FMIN= AUTO, the minimum for the FIRST station of each plot will be used.

Plot limits are presently restricted to decade (log2) boundaries.

Related modes: VMIN, VMAX, FMIN, FMAX.

Values: FMIN= AUTO, or low frequency limit, in Hz.

Default: FMIN= AUTO

**FMAX**

Mode FMAX specifies the right border of plots. When FMAX= AUTO, the maximum for the FIRST station of each plot will be used.

Plot limits are presently restricted to decade (log2) boundaries.

Related modes: VMIN, VMAX, FMIN, FMAX.

Values: FMAX= AUTO, or hi frequency limit, in Hz.

Default: FMAX= AUTO

### **SPLINE**

Station plots will be drawn with either a spline curve or linear segments through data points, depending upon mode SPLINE.

Values: SPLINE= Linear (No), or Spline (Yes).  
Default: SPLINE= Linear

### **NUMCURVES**

Log-log plots may include several curves per plot, as specified by mode NUMCURVES. The number of E-field channels for each H-field channel is often used as the NUMCURVES value.

Mode PLOT specifies which data to plot.  
Mode ERRORBARS selects plots with errorbars.  
Mode VIEW enables plot preview on screen.

Values: NUMCURVES= 0 or N curves per plot, up to 40.  
Default: NUMCURVES= 7

### **LMAG**

If mode LMAG= READ then stations will be listed in the order as read from the raw data file. If mode LMAG= HIMAG then the stations will be listed in the order of the high frequency magnitudes.

Values: LMAG= READ, HIMAG  
Default: LMAG= READ

### **ERRORBARS**

Error bars are available for averaged mag and resistivity data only.

The variation (sigma) is displayed as a percentage (coefficient of variation) in the .NL-file (data summary). Error bars greater than a minimum value (10%) are drawn between  $\log(\text{Avg}) + \log(1 \pm \text{Cvar}/100)$ . The same symbol used for the data curve is displayed over the error bar endpoints.

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. Note that plot limits are set by data for the first station of each plot.

Values: VIEW= NONE (No), or SCREEN (Yes)  
Default: VIEW= No



## Appendix B ... SAMPLE FILES

### Sample .LOG-file

AMTAVG 7.20, Processed: 29 Jul 93

GLOBAL MODE LIST:

-[COMPANY]----- Zonge Engineering		-[JOBNUMB]----- 9100		-[TXLEN]-----	
-[CLIENT]----- ZONGE ENGINEERING		-[JOBDATE]----- Jan 91		-[TXBRG]----- 5000 ft	
-[PROJECT]----- Sample Data		-[JOBLINE]-----		-[TXDIS]----- N 90 E	
-[BRGBACK]----- S 90 W	-[RXBRG]----- N 90 E	-[BRGLINE]----- N 90 E	-[FRQLO]----- 1/8 Hz	-[RX2TX]----- 3.5 mi	
-[STNLO]----- 0.0	-[STNDELT]----- 6.0	-[STNHI]----- 48.0	-[FRQHI]----- NONE	-[TXCX]----- North	
-[LBLFRST]----- STNLO	-[LBLDELT]----- 6.0	-[PLTREV]----- NO	-[UNITS]----- METERS	-[TXCY]-----	

PROCESSING MODES USED:

CONTROL MODES mode names mode values	AutoRun AUTO NO	AvgMethod CALC RECT	HarmLimit HARMONIC NONE	PhaseRef PHASEREF NO	Current NORMAL 1.0	
OUTPUT FILES mode names mode values	ListFile LFILE ALFILE	AvgFile DFILE ExHy	PlotFile ZFILE ExHy	StnSort SORT YES	StnLabel LABEL	
PLOT LIMITS mode names mode values	DataType PLOT RHO	MagLoLim VMIN AUTO	MagHiLim VMAX AUTO	FrqLoLim FMIN AUTO	FrqHiLim FMAX AUTO	
PLOT MODES mode names mode values	Spline SPLINE LINEAR	Spline NUMCURVES 10	LblSort LMAG READ	LblSort ERRORBARS YES	Preview VIEW SCREEN	

Files used: "SAMCSAM.FLD", and "SAMCSAM.MDE"

```
Station " 0. " (ExHy), line 26, 10 freqs: Data DONE
Station " 6. " (ExHy), line 49, 10 freqs: Data DONE
Station " 12. " (ExHy), line 75, 10 freqs: Data DONE
Station " 18. " (ExHy), line 101, 10 freqs: Data DONE
Station " 24. " (ExHy), line 132, 10 freqs: Data DONE
Station " 30. " (ExHy), line 167, 10 freqs: Data DONE
Station " 36. " (ExHy), line 204, 10 freqs: Data DONE
Station " 42. " (ExHy), line 237, 10 freqs: Data DONE
Station " 48. " (ExHy), line 260, 10 freqs: Data DONE
```

File "SAMCSAM.AVG" contains averaged data for 9 stations.

Files ready for rasterizing:

SAMCSAM.X01

Log file "SAMCSAM.LOG" closed.

GDP DATA PROCESSING MANUAL

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

PROJECT: Sample Data File: "SAMCSAM.FLD " CSAM0516, AMTAVG: 7.20  
 LINE: 1 STATION: 0. Tx: 1. A-Sp: 183.0m 29 Jul 93 REAL, IMAGINARY average

Pair:"ExHy"	ME==MAGNITUDE==MH==	CRNT	Coil	PE=PHZ=PH===	RHO=GDP=PD==	RHO=CALC=PHZ=
Blk Stks	(uV) g	(pT) g	amps	(mR) pi (mR) pi	(o-m) (mR)	(o-m) (mR) A
f= 8192 Hz =						
402 16384	965.50 9	1.584 8	4.5 30	1491 0 713 0	271.0 778	271.0 778 1
403 16384	962.48 9	1.570 8	4.5 30	1493 0 717 0	274.1 776	274.1 776 1
404 16384	970.24 9	1.592 8	4.5 30	1488 0 738 0	270.7 751	270.7 751 1
f= 4096 Hz =						
405 16384	1253.8 10	3.134 9	8.0 30	2088 0 1253 0	233.3 834	233.3 834 1
406 16384	1253.8 10	3.126 9	8.0 30	2087 0 1246 0	234.5 842	234.5 842 1
407 16384	1255.0 10	3.092 9	8.0 30	2087 0 1237 0	240.2 850	240.2 850 1
408 16384	1263.9 10	3.128 9	8.0 30	2086 0 1243 0	238.0 844	238.0 844 1
f= 2048 Hz =						
409 8192	1831.9 9	6.636 9	15.0 30	2451 0 1559 0	222.2 892	222.2 892 1
410 8192	1861.7 9	6.748 9	15.0 30	2450 0 1557 0	222.0 893	222.0 893 1
f= 1024 Hz =						
411 4096	2216.4 9	12.178 8	22.0 30	2809 0 1885 0	193.2 924	193.2 924 1
412 4096	2186.4 9	11.980 8	22.0 30	2809 0 1884 0	194.2 926	194.3 926 1
f= 512 Hz =						
413 2048	2132.2 9	17.945 9	27.0 30	3088 0 2171 0	164.7 917	164.7 917 1
414 2048	2131.2 9	17.964 9	27.0 30	3086 0 2171 0	164.2 915	164.2 915 1
f= 256 Hz =						
415 1024	1915.4 9	25.093 9	29.0 30	-3066 0 2360 0	135.9 858	135.9 -5426 1
416 1024	1916.5 9	25.116 9	29.0 30	-3065 0 2363 0	135.8 855	135.8 -5428 1
f= 128 Hz =						
417 512	1731.4 9	33.618 8	30.0 30	-3057 0 2472 0	123.7 755	123.8 -5528 1
418 512	1728.7 9	33.594 8	30.0 30	-3056 0 2476 0	123.5 751	123.5 -5532 1
f= 64 Hz =						
419 256	1604.5 8	42.027 9	30.0 30	-3070 0 2523 0	136.0 691	136.0 -5593 1
420 256	1599.9 8	41.844 9	30.0 30	-3076 0 2517 0	136.4 690	136.4 -5593 1
f= 32 Hz =						
421 128	1294.8 9	55.829 8	30.0 30	3015 0 2490 0	100.4 525	100.4 525 1
422 128	1283.1 9	55.394 8	30.0 30	3017 0 2490 0	100.1 527	100.1 527 1
423 128	1283.2 9	55.427 8	30.0 30	3015 0 2487 0	100.0 528	100.0 528 1
f= 16 Hz =						
424 256	1867.3 8	82.148 8	30.0 30	2698 0 2618 0	192.9 80	192.9 80 1
425 256	1880.7 8	82.699 8	30.0 30	2697 0 2615 0	193.0 82	193.0 82 1

PROJECT: Sample Data MagNorm= 1.0 amps CSAM0516, AMTAVG: 7.20  
 LINE: 1 STATION: 0. Tx: 1. A-Sp: 183.0m 29 Jul 93 REAL, IMAGINARY average

STATISTICS	Pair:"ExHy"	E---MAGNITUDE---H	E---MAG---H	*PARAMETER RHO *	*COMPONENT RHO *
Hz	(sigma)	(sigma)(C-var)	(C-var)	(sigma)(C-var)	(sigma)(C-var)
8192	4.750	0.005	0.4 1.4	4.494 1.7	4.494 1.7
4096	3.340	0.003	0.4 0.9	3.221 1.4	3.221 1.4
2048	7.676	0.005	1.1 1.2	0.193 0.1	0.193 0.1
1024	5.269	0.006	1.0 1.2	0.757 0.4	0.757 0.4
512	0.209	0.000	0.0 0.1	0.355 0.2	0.355 0.2
256	0.147	0.002	0.0 0.2	0.266 0.2	0.266 0.2
128	0.373	0.003	0.1 0.3	0.331 0.3	0.331 0.3
64	0.592	0.007	0.2 0.5	0.288 0.2	0.288 0.2
32	1.233	0.009	0.5 0.5	0.210 0.2	0.210 0.2
16	1.726	0.013	0.5 0.5	0.127 0.1	0.127 0.1

AVERAGE	ME--MAGNITUDE--MH	E---MAGNITUDE---H	E---PHASE---H	*PARAMETER AVG.*	*COMPONENT AVG.*
Hz	(uV) (pT)	nV/(Ma) pTesla/a	(mR) (mR)	RHO(o-m) PHZ(mR)	RHO(o-m) PHZ(mR)
8192	966.07 1.582	1173.1 0.351	1491. 723.	271.91 768.	271.95 768.
4096	1256.6 3.120	858.35 0.390	2087. 1245.	236.49 842.	236.48 842.
2048	1846.8 6.692	672.79 0.446	2450. 1558.	222.09 893.	222.09 893.
1024	2201.4 12.079	546.80 0.549	2809. 1884.	193.72 925.	193.72 925.
512	2131.7 17.955	431.43 0.665	3087. 2171.	164.42 916.	164.42 916.
256	1915.9 25.104	361.02 0.866	-3066. 2361.	135.88 856.	135.88 856.
128	1730.0 33.606	315.13 1.120	-3056. 2474.	123.65 753.	123.65 753.
64	1602.2 41.935	291.84 1.398	-3073. 2520.	136.21 690.	136.21 690.
32	1287.0 55.550	234.43 1.852	3015. 2489.	100.18 526.	100.18 526.
16	1874.0 82.423	341.35 2.747	2697. 2616.	192.95 81.	192.95 81.

1

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

```

/* Transferred from a GDP
0401
CSAM0516 91-01-01 11:35:53 12.4v
OPER 1 TX ID 2017 A-SP 183.0
JOB 91000 LINE 1.0 N SPREAD 3
1 LoPass Notch+60,3-5,9 S/N 1036 Passed 0.99808
2 LoPass Notch+60,3-5,9 S/N 1039 Passed 0.99821
3 LoPass Notch+60,3-5,9 S/N 1041 Passed 1.00110
4 LoPass Notch+60,3-5,9 S/N 132 Passed 0.99725
5 LoPass Notch+60,3-5,9 S/N 260 Passed 1.00179
6 LoPass Notch+60,3-5,9 S/N 269 Passed 0.99574
7 LoPass Notch+60,3-5,9 S/N 267 Passed 0.99492
8 LoPass Notch+60,3-5,9 S/N 261 Passed 0.99588

0402
CSAM0516 91-01-01 11:43:46 12.6v
Tx 1 Rx 0 N 60, 5
8192 Hz 16384 Cvc Tx Curr 4.50
1 Ex 0 965.50u 1491.2 271.0 0360 6.54 20.36 4.42K
2 Hy 30 1.5836u 712.8 778.4 0260 10.31 -4.26 -1.76K

0403
CSAM0516 91-01-01 11:44:08 12.5v
Tx 1 Rx 0 N 60, 5
8192 Hz 16384 Cvc Tx Curr 4.50
1 Ex 0 962.48u 1493.4 274.1 0360 2.63 20.36 4.42K
2 Hy 30 1.5697u 717.2 776.2 0260 15.71 -4.26 -1.76K

0404
CSAM0516 91-01-01 11:44:30 12.5v
Tx 1 Rx 0 N 60, 5
8192 Hz 16384 Cvc Tx Curr 4.50
1 Ex 0 970.24u 1488.4 270.7 0360 5.32 20.36 4.42K
2 Hy 30 1.5922u 737.9 750.6 0260 15.32 -4.26 -1.76K

0405
CSAM0516 91-01-01 11:47:45 12.5v
Tx 1 Rx 0 N 60, 5
4096 Hz 16384 Cvc Tx Curr 8.00
1 Ex 0 1.2538m 2087.6 233.3 0460 0.29 20.78 4.42K
2 Hy 30 3.1344u 1253.3 834.2 0360 4.01 -4.13 -1.76K

0406
CSAM0516 91-01-01 11:48:17 12.5v
Tx 1 Rx 0 N 60, 5
4096 Hz 16384 Cvc Tx Curr 8.00
1 Ex 0 1.2538m 2087.3 234.5 0460 0.12 20.78 4.42K
2 Hy 30 3.1263u 1245.5 841.8 0360 5.61 -4.13 -1.76K

0407
CSAM0516 91-01-01 11:48:48 12.5v
Tx 1 Rx 0 N 60, 5
4096 Hz 16384 Cvc Tx Curr 8.00
1 Ex 0 1.2550m 2087.0 240.2 0460 0.11 20.78 4.42K
2 Hy 30 3.0923u 1237.1 849.9 0360 4.65 -4.13 -1.76K

0408
CSAM0516 91-01-01 11:49:38 12.5v
Tx 1 Rx 0 N 60, 5
4096 Hz 16384 Cvc Tx Curr 8.00
1 Ex 0 1.2639m 2086.2 238.0 0460 0.17 20.78 4.42K
2 Hy 30 3.1283u 1242.6 843.6 0360 5.33 -4.13 -1.76K

0409
CSAM0516 91-01-01 11:52:07 12.5v
Tx 1 Rx 0 N 60, 5
2048 Hz 8192 Cvc Tx Curr 15.00
1 Ex 0 1.8319m 2450.6 222.2 0360 0.06 20.91 4.42K
2 Hy 30 6.6359u 1558.7 891.9 0360 1.87 -3.99 -1.76K

0410
CSAM0516 91-01-01 11:52:35 12.5v
Tx 1 Rx 0 N 60, 5
2048 Hz 8192 Cvc Tx Curr 15.00
1 Ex 0 1.8617m 2450.2 222.0 0360 0.07 20.91 4.42K
2 Hy 30 6.7480u 1556.9 893.3 0360 2.54 -3.99 -1.76K

0411
CSAM0516 91-01-01 11:54:25 12.5v
Tx 1 Rx 0 N 60, 5
1024 Hz 4096 Cvc Tx Curr 22.00
1 Ex 0 2.2164m 2809.1 193.2 0360 0.11 21.19 4.42K
2 Hy 30 12.178u 1884.7 924.3 0260 1.68 -3.85 -1.76K

0412
CSAM0516 91-01-01 11:54:50 12.5v
Tx 1 Rx 0 N 60, 5
1024 Hz 4096 Cvc Tx Curr 22.00
1 Ex 0 2.1864m 2809.2 194.2 0360 0.10 21.19 4.42K
2 Hy 30 11.980u 1883.5 925.7 0260 1.81 -3.85 -1.76K

0413
CSAM0516 91-01-01 11:57:09 12.5v
Tx 1 Rx 0 N 60, 5
512 Hz 2048 Cvc Tx Curr 27.00
1 Ex 0 2.1322m 3088.0 164.7 0360 0.60 21.05 4.42K
2 Hy 30 17.945u 2170.9 917.0 0360 1.28 -3.99 -1.76K

```

continued ...

Sample .RAW-file (partial: page 2)

```

0414
CSAM0516 91-01-01 11:57:33 12.5v
Tx 1 Rx 0 N 60, 5
512 Hz 2048 Cyc Tx Curr 27.00
1 Ex 0 2.1312m 3086.0 164.2 0360 0.78 21.05 4.42K
2 Hy 30 17.964u 2170.6 915.4 0360 1.52 -3.99 -1.76K

0415
CSAM0516 91-01-01 11:58:58 12.5v
Tx 1 Rx 0 N 60, 5
256 Hz 1024 Cyc Tx Curr 29.00
1 Ex 0 1.9154m -3065.7 135.9 0360 0.35 20.78 4.42K
2 Hy 30 25.093u 2359.8 857.7 0360 0.75 -3.99 -1.76K

0416
CSAM0516 91-01-01 11:59:14 12.5v
Tx 1 Rx 0 N 60, 5
256 Hz 1024 Cyc Tx Curr 29.00
1 Ex 0 1.9165m -3065.4 135.8 0360 0.22 20.78 4.42K
2 Hy 30 25.116u 2362.8 855.0 0360 0.93 -3.99 -1.76K

0417
CSAM0516 91-01-01 12:00:16 12.6v
Tx 1 Rx 0 N 60, 5
128 Hz 512 Cyc Tx Curr 30.00
1 Ex 0 1.7314m -3056.9 123.7 0360 0.68 21.05 4.42K
2 Hy 30 33.618u 2471.5 754.8 0260 1.84 -2.89 -1.76K

0418
CSAM0516 91-01-01 12:00:24 12.5v
Tx 1 Rx 0 N 60, 5
128 Hz 512 Cyc Tx Curr 30.00
1 Ex 0 1.7287m -3056.1 123.5 0360 0.98 21.05 4.42K
2 Hy 30 33.594u 2476.2 750.8 0260 1.97 -2.89 -1.76K

0419
CSAM0516 91-01-01 12:01:05 12.5v
Tx 1 Rx 0 N 60, 5
64 Hz 256 Cyc Tx Curr 30.00
1 Ex 0 1.6045m -3069.8 136.0 0260 2.65 21.05 4.42K
2 Hy 30 42.027u 2522.9 690.5 0360 1.77 -3.03 -1.76K

0420
CSAM0516 91-01-01 12:02:02 12.5v
Tx 1 Rx 0 N 60, 5
64 Hz 256 Cyc Tx Curr 30.00
1 Ex 0 1.5999m -3076.2 136.4 0260 0.70 21.05 4.42K
2 Hy 30 41.844u 2516.9 690.1 0360 1.29 -3.03 -1.76K

0421
CSAM0516 91-01-01 12:02:42 12.5v
Tx 1 Rx 0 N 60, 5
32 Hz 128 Cyc Tx Curr 30.00
1 Ex 0 1.2948m 3014.7 100.4 0360 0.44 20.78 4.42K
2 Hy 30 55.829u 2489.7 525.0 0260 3.60 -2.89 -1.76K

0422
CSAM0516 91-01-01 12:03:03 12.5v
Tx 1 Rx 0 N 60, 5
32 Hz 128 Cyc Tx Curr 30.00
1 Ex 0 1.2831m 3016.5 100.1 0360 0.56 20.78 4.42K
2 Hy 30 55.394u 2489.9 526.6 0260 1.18 -2.89 -1.76K

0423
CSAM0516 91-01-01 12:03:16 12.5v
Tx 1 Rx 0 N 60, 5
32 Hz 128 Cyc Tx Curr 30.00
1 Ex 0 1.2832m 3014.8 100.0 0360 0.61 20.78 4.42K
2 Hy 30 55.427u 2487.1 527.7 0260 1.25 -2.89 -1.76K

0424
CSAM0516 91-01-01 12:04:12 12.5v
Tx 1 Rx 0 N 60, 5
16 Hz 256 Cyc Tx Curr 30.00
1 Ex 0 1.8673m 2697.7 192.9 0260 1.06 21.33 4.42K
2 Hy 30 82.148u 2617.5 80.2 0260 1.89 -3.03 -1.76K

0425
CSAM0516 91-01-01 12:04:35 12.5v
Tx 1 Rx 0 N 60, 5
16 Hz 256 Cyc Tx Curr 30.00
1 Ex 0 1.8807m 2696.9 193.0 0260 1.14 21.33 4.42K
2 Hy 30 82.699u 2615.1 81.8 0260 2.96 -3.03 -1.76K

*** end-of-file ***

```



GDP DATA PROCESSING MANUAL

Sample .FLD-file (partial: only data for Stn=0) (data columns displayed in three sections)

```
Reference ruler line
-----1-----2-----3-----4-----5-----6-----7-----8
/* SHRED v3.36: "SAMCSAM.FLD"
H 1 0401 1 0 CSAM0516 91-01-01 11:35:53 12.4 --- 1 2017 183.0 1 1.0 N 3
D 1 0402 1 0 91-01-01 11:43:46 12.6 8192 16384 4.50 1 0
D 1 0403 1 0 91-01-01 11:44:08 12.5 8192 16384 4.50 1 0
D 1 0404 1 0 91-01-01 11:44:30 12.5 8192 16384 4.50 1 0
D 1 0405 1 0 91-01-01 11:47:45 12.5 4096 16384 8.00 1 0
D 1 0406 1 0 91-01-01 11:48:17 12.5 4096 16384 8.00 1 0
D 1 0407 1 0 91-01-01 11:48:48 12.5 4096 16384 8.00 1 0
D 1 0408 1 0 91-01-01 11:49:38 12.5 4096 16384 8.00 1 0
D 1 0409 1 0 91-01-01 11:52:07 12.5 2048 8192 15.00 1 0
D 1 0410 1 0 91-01-01 11:52:35 12.5 2048 8192 15.00 1 0
D 1 0411 1 0 91-01-01 11:54:25 12.5 1024 4096 22.00 1 0
D 1 0412 1 0 91-01-01 11:54:50 12.5 1024 4096 22.00 1 0
D 1 0413 1 0 91-01-01 11:57:09 12.5 512 2048 27.00 1 0
D 1 0414 1 0 91-01-01 11:57:33 12.5 512 2048 27.00 1 0
D 1 0415 1 0 91-01-01 11:58:58 12.5 256 1024 29.00 1 0
D 1 0416 1 0 91-01-01 11:59:14 12.5 256 1024 29.00 1 0
D 1 0417 1 0 91-01-01 12:00:16 12.6 128 512 30.00 1 0
D 1 0418 1 0 91-01-01 12:00:24 12.5 128 512 30.00 1 0
D 1 0419 1 0 91-01-01 12:01:05 12.5 64 256 30.00 1 0
D 1 0420 1 0 91-01-01 12:02:02 12.5 64 256 30.00 1 0
D 1 0421 1 0 91-01-01 12:02:42 12.5 32 128 30.00 1 0
D 1 0422 1 0 91-01-01 12:03:03 12.5 32 128 30.00 1 0
D 1 0423 1 0 91-01-01 12:03:16 12.5 32 128 30.00 1 0
D 1 0424 1 0 91-01-01 12:04:12 12.5 16 256 30.00 1 0
D 1 0425 1 0 91-01-01 12:04:35 12.5 16 256 30.00 1 0
```

```
-----9-----10-----11-----12-----13-----14-----15-----16-----
Ex 0 0 965.50e-6 1491.2 271.0 0360 6.54 20.36 4.42e+3 1
Ex 0 0 962.48e-6 1493.4 274.1 0360 2.63 20.36 4.42e+3 1
Ex 0 0 970.24e-6 1488.4 270.7 0360 5.32 20.36 4.42e+3 1
Ex 0 0 1.2538e-3 2087.6 233.3 0460 0.29 20.78 4.42e+3 1
Ex 0 0 1.2538e-3 2087.3 234.5 0460 0.12 20.78 4.42e+3 1
Ex 0 0 1.2550e-3 2087.0 240.2 0460 0.11 20.78 4.42e+3 1
Ex 0 0 1.2639e-3 2086.2 238.0 0460 0.17 20.78 4.42e+3 1
Ex 0 0 1.8319e-3 2450.6 222.2 0360 0.06 20.91 4.42e+3 1
Ex 0 0 1.8617e-3 2450.2 222.0 0360 0.07 20.91 4.42e+3 1
Ex 0 0 2.2164e-3 2809.1 193.2 0360 0.11 21.19 4.42e+3 1
Ex 0 0 2.1864e-3 2809.2 194.2 0360 0.10 21.19 4.42e+3 1
Ex 0 0 2.1322e-3 3088.0 164.7 0360 0.60 21.05 4.42e+3 1
Ex 0 0 2.1312e-3 3086.0 164.2 0360 0.78 21.05 4.42e+3 1
Ex 0 0 1.9154e-3 -3065.7 135.9 0360 0.35 20.78 4.42e+3 1
Ex 0 0 1.9165e-3 -3065.4 135.8 0360 0.22 20.78 4.42e+3 1
Ex 0 0 1.7314e-3 -3056.9 123.7 0360 0.68 21.05 4.42e+3 1
Ex 0 0 1.7287e-3 -3056.1 123.5 0360 0.98 21.05 4.42e+3 1
Ex 0 0 1.6045e-3 -3069.8 136.0 0260 2.65 21.05 4.42e+3 1
Ex 0 0 1.5999e-3 -3076.2 136.4 0260 0.70 21.05 4.42e+3 1
Ex 0 0 1.2948e-3 3014.7 100.4 0360 0.44 20.78 4.42e+3 1
Ex 0 0 1.2831e-3 3016.5 100.1 0360 0.56 20.78 4.42e+3 1
Ex 0 0 1.2832e-3 3014.8 100.0 0360 0.61 20.78 4.42e+3 1
Ex 0 0 1.8673e-3 2697.7 192.9 0260 1.06 21.33 4.42e+3 1
Ex 0 0 1.8807e-3 2696.9 193.0 0260 1.14 21.33 4.42e+3 1
```

```
17-----18-----19-----20-----21-----22-----23-----24-----25-----
Hy 0 30 1.5836e-6 712.8 778.4 0260 10.31 -4.26 -1.76e+3 1
Hy 0 30 1.5697e-6 717.2 776.2 0260 15.71 -4.26 -1.76e+3 1
Hy 0 30 1.5922e-6 737.9 750.5 0260 15.32 -4.26 -1.76e+3 1
Hy 0 30 3.1344e-6 1253.3 834.3 0360 4.01 -4.13 -1.76e+3 1
Hy 0 30 3.1263e-6 1245.5 841.8 0360 5.61 -4.13 -1.76e+3 1
Hy 0 30 3.0923e-6 1237.1 849.9 0360 4.65 -4.13 -1.76e+3 1
Hy 0 30 3.1283e-6 1242.6 843.6 0360 5.33 -4.13 -1.76e+3 1
Hy 0 30 6.6359e-6 1558.7 891.9 0360 1.87 -3.99 -1.76e+3 1
Hy 0 30 6.7480e-6 1556.9 893.3 0360 2.54 -3.99 -1.76e+3 1
Hy 0 30 12.178e-6 1884.7 924.4 0260 1.68 -3.85 -1.76e+3 1
Hy 0 30 11.980e-6 1883.5 925.7 0260 1.81 -3.85 -1.76e+3 1
Hy 0 30 17.945e-6 2170.9 917.1 0360 1.28 -3.99 -1.76e+3 1
Hy 0 30 17.964e-6 2170.6 915.4 0360 1.52 -3.99 -1.76e+3 1
Hy 0 30 25.093e-6 2359.8 857.7 0360 0.75 -3.99 -1.76e+3 1
Hy 0 30 25.116e-6 2362.8 855.0 0360 0.93 -3.99 -1.76e+3 1
Hy 0 30 33.618e-6 2471.5 754.8 0260 1.84 -2.89 -1.76e+3 1
Hy 0 30 33.594e-6 2476.2 750.9 0260 1.97 -2.89 -1.76e+3 1
Hy 0 30 42.027e-6 2522.9 690.5 0360 1.77 -3.03 -1.76e+3 1
Hy 0 30 41.844e-6 2516.9 690.1 0360 1.29 -3.03 -1.76e+3 1
Hy 0 30 55.829e-6 2489.7 525.0 0260 3.60 -2.89 -1.76e+3 1
Hy 0 30 55.394e-6 2489.9 526.6 0260 1.18 -2.89 -1.76e+3 1
Hy 0 30 55.427e-6 2487.1 527.7 0260 1.25 -2.89 -1.76e+3 1
Hy 0 30 82.148e-6 2617.5 80.2 0260 1.89 -3.03 -1.76e+3 1
Hy 0 30 82.699e-6 2615.1 81.8 0260 2.96 -3.03 -1.76e+3 1
```

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GDP DATA PROCESSING MANUAL

**Sample .AD-file**

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From AMTAVG 7.20: "SAMCSAM.AD " v4.0                                GDP AMT 0516
/* Data for components ExHy
/* 29 Jul 93
Client : ZONGE ENGINEERING
Project: Sample Data
Line   : 1
Grid used : 1000 meter Universal Transverse Mercator grid, zone 12
Grid north:      North      Grid scale:      1.00 m / grid unit.
Tn   TX 1      East      5000 ft      Xc      Yc      Zc
Rn   0.0      East      183.0m AP1 Xc      Yc      Zc
F23.1 8192 Hz Em 1.1731E+00 Ep 1.4910E+00 Hm 3.5150E-04 Hp 7.2268E-01
F22.1 4096 Hz Em 8.5835E-01 Ep 2.0870E+00 Hm 3.9003E-04 Hp 1.2447E+00
F21.1 2048 Hz Em 6.7279E-01 Ep 2.4504E+00 Hm 4.4613E-04 Hp 1.5578E+00
F20.1 1024 Hz Em 5.4680E-01 Ep 2.8091E+00 Hm 5.4905E-04 Hp 1.8841E+00
F19.1 512 Hz Em 4.3143E-01 Ep 3.0870E+00 Hm 6.6498E-04 Hp 2.1707E+00
F18.1 256 Hz Em 3.6102E-01 Ep-3.0655E+00 Hm 8.6567E-04 Hp 2.3613E+00
F17.1 128 Hz Em 3.1513E-01 Ep-3.0565E+00 Hm 1.1202E-03 Hp 2.4738E+00
F16.1 64 Hz Em 2.9184E-01 Ep-3.0730E+00 Hm 1.3978E-03 Hp 2.5199E+00
F15.1 32 Hz Em 2.3443E-01 Ep 3.0153E+00 Hm 1.8517E-03 Hp 2.4889E+00
F14.1 16 Hz Em 3.4135E-01 Ep 2.6973E+00 Hm 2.7474E-03 Hp 2.6163E+00
Rn   6.0      East      183.0m AP1 Xc      Yc      Zc
F23.1 8192 Hz Em 1.2513E+00 Ep-2.1115E+00 Hm 3.6216E-04 Hp-3.0365E+00
F22.1 4096 Hz Em 8.5772E-01 Ep-1.2672E+00 Hm 3.8044E-04 Hp-2.1839E+00
F21.1 2048 Hz Em 6.4934E-01 Ep-7.8580E-01 Hm 4.2923E-04 Hp-1.7624E+00
F20.1 1024 Hz Em 5.0469E-01 Ep-3.7330E-01 Hm 5.2905E-04 Hp-1.3556E+00
F19.1 512 Hz Em 3.9387E-01 Ep-7.3850E-02 Hm 6.4048E-04 Hp-1.0314E+00
F18.1 256 Hz Em 3.2680E-01 Ep 6.8550E-02 Hm 8.3859E-04 Hp-8.1940E-01
F17.1 128 Hz Em 2.8114E-01 Ep 9.2650E-02 Hm 1.0776E-03 Hp-7.0960E-01
F16.1 64 Hz Em 2.6778E-01 Ep 8.7049E-02 Hm 1.4003E-03 Hp-6.3590E-01
F15.1 32 Hz Em 2.0597E-01 Ep-8.5031E-03 Hm 1.8163E-03 Hp-6.7950E-01
F14.1 16 Hz Em 2.6405E-01 Ep-4.4221E-01 Hm 2.6760E-03 Hp-5.4645E-01
Rn  12.0      East      183.0m AP1 Xc      Yc      Zc
F23.1 8192 Hz Em 1.5175E+00 Ep-3.1283E+00 Hm 3.5544E-04 Hp 2.4246E+00
F22.1 4096 Hz Em 1.0776E+00 Ep-1.8189E+00 Hm 3.5323E-04 Hp-2.6170E+00
F21.1 2048 Hz Em 8.4220E-01 Ep-1.0800E+00 Hm 4.0646E-04 Hp-2.0018E+00
F20.1 1024 Hz Em 6.6369E-01 Ep-5.3215E-01 Hm 4.9443E-04 Hp-1.4814E+00
F19.1 512 Hz Em 5.2781E-01 Ep-1.7010E-01 Hm 6.0843E-04 Hp-1.1041E+00
F18.1 256 Hz Em 4.4406E-01 Ep-7.5707E-03 Hm 8.0176E-04 Hp-8.6153E-01
F17.1 128 Hz Em 3.9475E-01 Ep 1.8199E-02 Hm 1.0473E-03 Hp-7.2190E-01
F16.1 64 Hz Em 3.8188E-01 Ep 2.3951E-02 Hm 1.3362E-03 Hp-6.4690E-01
F15.1 32 Hz Em 3.0221E-01 Ep-1.4655E-01 Hm 1.7584E-03 Hp-6.7690E-01
F14.1 16 Hz Em 4.4644E-01 Ep-4.9160E-01 Hm 2.6151E-03 Hp-5.4893E-01
Rn  18.0      East      183.0m AP1 Xc      Yc      Zc
F23.1 8192 Hz Em 1.6965E+00 Ep 2.4320E+00 Hm 3.1821E-04 Hp 1.4835E+00
F22.1 4096 Hz Em 1.1682E+00 Ep-2.1628E+00 Hm 3.4951E-04 Hp-3.0862E+00
F21.1 2048 Hz Em 8.8357E-01 Ep-1.2382E+00 Hm 4.0162E-04 Hp-2.2064E+00
F20.1 1024 Hz Em 6.8430E-01 Ep-6.1460E-01 Hm 4.8870E-04 Hp-1.6147E+00
F19.1 512 Hz Em 5.3223E-01 Ep-1.9250E-01 Hm 5.9619E-04 Hp-1.1804E+00
F18.1 256 Hz Em 4.3459E-01 Ep-1.5452E-03 Hm 7.7973E-04 Hp-9.0395E-01
F17.1 128 Hz Em 3.8217E-01 Ep 4.3606E-02 Hm 1.0276E-03 Hp-7.4715E-01
F16.1 64 Hz Em 3.6596E-01 Ep 6.0422E-02 Hm 1.2974E-03 Hp-6.4966E-01
F15.1 32 Hz Em 2.7788E-01 Ep-3.8604E-02 Hm 1.7036E-03 Hp-6.9051E-01
F14.1 16 Hz Em 3.7603E-01 Ep-4.9165E-01 Hm 2.5579E-03 Hp-5.5815E-01

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continued ...

Sample .AD-file (page 2)

Rn	24.0	East	183.0m	AP1	Xc	Yc	Zc			
F23.1	8192	Hz	Em	2.0018E+00	Ep	1.4534E+00	Hm	2.8862E-04	Hp	6.7263E-01
F22.1	4096	Hz	Em	1.4450E+00	Ep	-2.6614E+00	Hm	3.3326E-04	Hp	2.7657E+00
F21.1	2048	Hz	Em	1.1192E+00	Ep	-1.4857E+00	Hm	3.7744E-04	Hp	-2.4068E+00
F20.1	1024	Hz	Em	8.6714E-01	Ep	-7.1275E-01	Hm	4.4784E-04	Hp	-1.6839E+00
F19.1	512	Hz	Em	6.6926E-01	Ep	-2.4015E-01	Hm	5.4469E-04	Hp	-1.2124E+00
F18.1	256	Hz	Em	5.1201E-01	Ep	-2.8602E-02	Hm	6.6927E-04	Hp	-9.2145E-01
F17.1	128	Hz	Em	4.9467E-01	Ep	2.6551E-02	Hm	9.7175E-04	Hp	-7.7120E-01
F16.1	64	Hz	Em	5.0064E-01	Ep	4.2602E-02	Hm	1.3067E-03	Hp	-6.5790E-01
F15.1	32	Hz	Em	3.7409E-01	Ep	-3.3155E-02	Hm	1.6845E-03	Hp	-6.7655E-01
F14.1	16	Hz	Em	5.1261E-01	Ep	-5.1510E-01	Hm	2.5315E-03	Hp	-5.6250E-01
Rn	30.0	East	183.0m	AP1	Xc	Yc	Zc			
F23.1	8192	Hz	Em	1.0969E+00	Ep	-1.6674E+00	Hm	2.9457E-04	Hp	-2.3258E+00
F22.1	4096	Hz	Em	7.8682E-01	Ep	-1.0519E+00	Hm	2.9363E-04	Hp	-1.8430E+00
F21.1	2048	Hz	Em	6.1638E-01	Ep	-6.6215E-01	Hm	3.2983E-04	Hp	-1.5748E+00
F20.1	1024	Hz	Em	4.7630E-01	Ep	-2.8783E-01	Hm	3.9858E-04	Hp	-1.2639E+00
F19.1	512	Hz	Em	3.6720E-01	Ep	-1.6566E-02	Hm	4.7574E-04	Hp	-1.0089E+00
F18.1	256	Hz	Em	3.0297E-01	Ep	9.3601E-02	Hm	6.4638E-04	Hp	-8.2110E-01
F17.1	128	Hz	Em	2.6245E-01	Ep	9.7700E-02	Hm	8.5108E-04	Hp	-7.1523E-01
F16.1	64	Hz	Em	2.5341E-01	Ep	8.3701E-02	Hm	1.0888E-03	Hp	-6.3276E-01
F15.1	32	Hz	Em	1.8666E-01	Ep	3.8866E-02	Hm	1.3951E-03	Hp	-6.5305E-01
F14.1	16	Hz	Em	2.4393E-01	Ep	-5.1860E-01	Hm	2.0950E-03	Hp	-5.6560E-01
Rn	36.0	East	183.0m	AP1	Xc	Yc	Zc			
F23.1	8192	Hz	Em	1.3909E+00	Ep	-1.6305E+00	Hm	2.9845E-04	Hp	-2.2317E+00
F22.1	4096	Hz	Em	9.9495E-01	Ep	-1.0509E+00	Hm	2.8522E-04	Hp	-1.8242E+00
F21.1	2048	Hz	Em	7.8571E-01	Ep	-6.6600E-01	Hm	3.2131E-04	Hp	-1.5339E+00
F20.1	1024	Hz	Em	6.0881E-01	Ep	-2.8987E-01	Hm	3.8106E-04	Hp	-1.2316E+00
F19.1	512	Hz	Em	4.6744E-01	Ep	-1.7835E-02	Hm	4.5015E-04	Hp	-9.9050E-01
F18.1	256	Hz	Em	3.8347E-01	Ep	9.1500E-02	Hm	6.0522E-04	Hp	-8.1167E-01
F17.1	128	Hz	Em	3.3563E-01	Ep	9.8635E-02	Hm	8.1093E-04	Hp	-7.0140E-01
F16.1	64	Hz	Em	3.2922E-01	Ep	8.1158E-02	Hm	1.0407E-03	Hp	-6.2449E-01
F15.1	32	Hz	Em	2.4422E-01	Ep	5.1776E-02	Hm	1.3326E-03	Hp	-6.3690E-01
F14.1	16	Hz	Em	3.0535E-01	Ep	-5.2880E-01	Hm	1.9452E-03	Hp	-5.6456E-01
Rn	42.0	East	183.0m	AP1	Xc	Yc	Zc			
F23.1	8192	Hz	Em	1.2131E+00	Ep	-4.7159E-01	Hm	2.7422E-04	Hp	-1.1139E+00
F22.1	4096	Hz	Em	9.0781E-01	Ep	-4.8860E-01	Hm	2.8341E-04	Hp	-1.1797E+00
F21.1	2048	Hz	Em	7.2021E-01	Ep	-4.0513E-01	Hm	3.0157E-04	Hp	-1.1691E+00
F20.1	1024	Hz	Em	5.7228E-01	Ep	-1.6803E-01	Hm	3.5195E-04	Hp	-1.0430E+00
F19.1	512	Hz	Em	4.3890E-01	Ep	-3.1059E+00	Hm	4.3269E-04	Hp	2.2572E+00
F18.1	256	Hz	Em	3.6474E-01	Ep	1.6836E+00	Hm	5.6368E-04	Hp	8.1855E-01
F17.1	128	Hz	Em	3.1866E-01	Ep	8.9490E-01	Hm	7.3635E-04	Hp	9.5873E-02
F16.1	64	Hz	Em	3.1227E-01	Ep	4.8733E-01	Hm	9.6601E-04	Hp	-1.9049E-01
F15.1	32	Hz	Em	2.3070E-01	Ep	-2.8186E+00	Hm	1.1810E-03	Hp	2.7072E+00
F14.1	16	Hz	Em	2.6395E-01	Ep	1.1493E+00	Hm	1.7723E-03	Hp	1.0945E+00
Rn	48.0	East	183.0m	AP1	Xc	Yc	Zc			
F23.1	8192	Hz	Em	8.1509E-01	Ep	-4.7082E-01	Hm	2.9521E-04	Hp	-9.7402E-01
F22.1	4096	Hz	Em	6.2295E-01	Ep	-4.8907E-01	Hm	2.7569E-04	Hp	-1.1514E+00
F21.1	2048	Hz	Em	4.9481E-01	Ep	-4.0650E-01	Hm	3.0274E-04	Hp	-1.1802E+00
F20.1	1024	Hz	Em	3.9242E-01	Ep	-1.6420E-01	Hm	3.5530E-04	Hp	-1.0449E+00
F19.1	512	Hz	Em	3.0773E-01	Ep	-3.0955E+00	Hm	4.3108E-04	Hp	2.2456E+00
F18.1	256	Hz	Em	2.4759E-01	Ep	1.6959E+00	Hm	5.5445E-04	Hp	8.0665E-01
F17.1	128	Hz	Em	2.1577E-01	Ep	9.1105E-01	Hm	7.3018E-04	Hp	9.1208E-02
F16.1	64	Hz	Em	2.1024E-01	Ep	5.0850E-01	Hm	9.5573E-04	Hp	-2.0505E-01
F15.1	32	Hz	Em	1.5808E-01	Ep	-2.7170E+00	Hm	1.1366E-03	Hp	2.7119E+00
F14.1	16	Hz	Em	1.4876E-01	Ep	1.1948E+00	Hm	1.6987E-03	Hp	1.0683E+00

\*\*\* end-of-file \*\*\*

GDP DATA PROCESSING MANUAL

Sample .AVG-file

\ AMTAVG 7.20: "SAMCSAM.FLD", Dated 91-01-01, Processed 29 Jul 93

\ \$ ASPACE= 183.0m

\ \$ XMTR = 1.

skp	Station	Freq	Comp	Amps	Emag	Ephz	Hmag	Hphz	Resistivity	Phase	%Emag	sEphz	%Hmag	sHphz	%Rho	sPhz
2	0.0	8192	ExHy	4.5	1.1731e+3	1491.0	3.5150e-1	722.7	2.7195e+2	768.3	0.4	3.1	1.4	14.7	1.7	16.6
2	0.0	4096	ExHy	8.	8.5835e+2	2087.0	3.9003e-1	1244.7	2.3648e+2	842.4	0.4	3.1	0.9	7.1	1.4	12.9
2	0.0	2048	ExHy	15.	6.7279e+2	2450.4	4.4613e-1	1557.8	2.2209e+2	892.6	1.1	11.3	1.2	1.6	0.1	1.1
2	0.0	1024	ExHy	22.	5.4680e+2	2809.1	5.4905e-1	1884.1	1.9372e+2	925.0	1.0	6.0	1.2	7.5	0.4	3.5
2	0.0	512	ExHy	27.	4.3143e+2	3087.0	6.6498e-1	2170.8	1.6442e+2	916.3	0.0	1.4	0.1	0.6	0.2	1.8
2	0.0	256	ExHy	29.	3.6102e+2	-3065.5	8.6567e-1	2361.3	1.3588e+2	856.3	0.0	0.3	0.2	2.1	0.2	1.9
2	0.0	128	ExHy	30.	3.1513e+2	-3056.5	1.1202e+0	2473.8	1.2365e+2	752.8	0.1	0.6	0.3	3.3	0.3	2.8
2	0.0	64	ExHy	30.	2.9184e+2	-3073.0	1.3978e+0	2519.9	1.1428e+2	690.3	0.2	4.8	0.5	4.2	0.2	2.0
2	0.0	32	ExHy	30.	2.3443e+2	3015.3	1.8517e+0	2488.9	1.0018e+2	526.4	0.5	2.1	0.5	4.3	0.2	1.4
2	0.0	16	ExHy	30.	3.4135e+2	2697.3	2.7474e+0	2616.3	1.9295e+2	81.0	0.5	4.3	0.5	4.9	0.1	1.2
2	6.0	8192	ExHy	4.5	1.2513e+3	-2111.5	3.6216e-1	-3036.5	2.9142e+2	925.0	1.0	12.0	1.3	12.8	2.4	19.8
2	6.0	4096	ExHy	8.	8.5772e+2	-1267.2	3.8044e-1	-2183.9	2.4819e+2	916.7	0.2	3.0	0.7	8.3	1.2	12.0
2	6.0	2048	ExHy	15.	6.4934e+2	-785.8	4.2923e-1	-1762.4	2.2349e+2	976.6	0.1	1.1	0.4	4.3	0.5	3.2
2	6.0	1024	ExHy	22.	5.0469e+2	-373.3	5.2905e-1	-1355.6	1.7775e+2	982.3	0.1	0.4	0.1	1.7	0.2	2.0
2	6.0	512	ExHy	27.	3.9387e+2	-73.8	6.4048e-1	-1031.4	1.4772e+2	957.5	0.0	1.5	0.1	0.9	0.2	2.7
2	6.0	256	ExHy	29.	3.2680e+2	68.6	8.3859e-1	-819.4	1.1856e+2	887.9	0.1	0.4	0.1	0.9	0.3	2.8
2	6.0	128	ExHy	30.	2.8114e+2	92.6	1.0776e+0	-709.6	1.0635e+2	802.3	0.0	0.3	0.0	0.3	0.1	0.5
2	6.0	64	ExHy	30.	2.6778e+2	87.0	1.4003e+0	-635.9	1.1428e+2	722.9	0.1	1.1	0.3	2.5	0.2	2.2
2	6.0	32	ExHy	30.	2.0597e+2	-8.5	1.8163e+0	-679.5	8.0377e+1	671.0	0.1	1.4	0.2	1.7	0.2	1.9
2	6.0	16	ExHy	30.	2.6405e+2	-442.2	2.6760e+0	-546.5	1.2170e+2	104.2	0.3	4.6	0.2	2.2	0.5	1.2
2	12.0	8192	ExHy	4.5	1.5175e+3	-3128.3	3.5544e-1	2424.6	4.4503e+2	730.3	0.6	13.9	2.4	25.7	3.7	36.7
2	12.0	4096	ExHy	8.	1.0776e+3	-1818.9	3.5323e-1	-2617.0	4.5444e+2	798.1	0.2	3.8	0.5	5.3	1.0	9.6
2	12.0	2048	ExHy	15.	8.4220e+2	-1080.0	4.0646e-1	-2001.8	4.1928e+2	921.8	0.1	1.0	0.2	1.4	0.3	2.5
2	12.0	1024	ExHy	22.	6.6369e+2	-532.1	4.9443e-1	-1481.4	3.5192e+2	949.3	0.0	0.3	0.0	1.8	0.2	1.7
2	12.0	512	ExHy	27.	5.2781e+2	-170.1	6.0843e-1	-1104.1	2.9397e+2	933.9	0.1	2.0	0.3	1.8	0.3	2.4
2	12.0	256	ExHy	29.	4.4406e+2	-7.6	8.0176e-1	-861.5	2.3966e+2	854.0	0.1	0.2	0.1	0.9	0.1	0.9
2	12.0	128	ExHy	29.	3.9475e+2	18.2	1.0473e+0	-721.9	2.2197e+2	740.1	0.1	1.4	0.3	2.5	0.4	3.7
2	12.0	64	ExHy	30.	3.8188e+2	24.0	1.3362e+0	-646.9	2.5524e+2	670.8	0.1	1.2	0.3	2.5	0.5	5.0
2	12.0	32	ExHy	30.	3.0221e+2	-146.5	1.7584e+0	-676.9	1.8461e+2	530.4	0.3	5.0	0.2	2.3	0.2	3.4
2	12.0	16	ExHy	30.	4.4644e+2	-491.6	2.6151e+0	-548.9	3.6431e+2	57.3	0.1	1.3	0.2	2.1	0.4	1.9
2	18.0	8192	ExHy	4.5	1.6965e+3	2432.0	3.1821e-1	1483.5	6.9396e+2	948.4	1.8	18.0	2.8	24.0	4.8	46.8
2	18.0	4096	ExHy	8.	1.1682e+3	-2162.8	3.4951e-1	-3086.2	5.4546e+2	923.4	1.6	17.2	0.3	20.6	0.5	5.7
2	18.0	2048	ExHy	15.	8.8357e+2	-1238.2	4.0162e-1	-2206.4	4.7266e+2	968.2	0.0	1.0	0.6	6.4	0.4	5.4
2	18.0	1024	ExHy	22.	6.8430e+2	-614.6	4.8870e-1	-1614.7	3.8294e+2	1000.1	0.0	0.4	0.4	1.8	0.7	6.2
2	18.0	512	ExHy	26.	5.3223e+2	-192.5	5.9619e-1	-1180.4	3.1131e+2	987.9	0.2	0.7	0.1	1.5	0.2	2.6
2	18.0	256	ExHy	28.	4.3459e+2	-1.5	7.7973e-1	-904.0	2.4270e+2	902.4	0.0	0.6	0.1	1.3	0.1	1.4
2	18.0	128	ExHy	28.	3.8217e+2	43.6	1.0276e+0	-747.1	2.1611e+2	790.8	0.5	2.6	0.7	6.5	0.3	3.0
2	18.0	64	ExHy	30.	3.6596e+2	60.4	1.2974e+0	-649.7	2.4861e+2	710.1	0.7	10.4	0.9	10.4	0.6	5.7
2	18.0	32	ExHy	30.	2.7788e+2	-38.6	1.7036e+0	-690.5	1.6629e+2	651.9	0.2	5.4	0.4	4.2	0.2	2.0
2	18.0	16	ExHy	30.	3.7603e+2	-491.6	2.5579e+0	-558.1	2.7013e+2	66.5	0.3	1.8	0.3	2.2	0.0	0.4
2	24.0	8192	ExHy	4.	2.0018e+3	1453.4	2.8862e-1	672.6	1.1744e+3	780.8	0.5	6.7	3.1	31.1	3.7	36.6
2	24.0	4096	ExHy	8.	1.4450e+3	-2661.4	3.3326e-1	2765.7	9.1775e+2	856.0	0.5	4.2	1.2	13.7	2.2	22.2
2	24.0	2048	ExHy	15.	1.1192e+3	-1485.7	3.7744e-1	-2406.8	8.5868e+2	921.1	0.2	1.1	0.4	4.3	0.6	6.3
2	24.0	1024	ExHy	22.	8.6714e+2	-712.8	4.4784e-1	-1683.9	7.3252e+2	971.2	0.0	0.2	0.1	3.4	0.3	3.8
2	24.0	512	ExHy	26.	6.6926e+2	-240.2	5.4469e-1	-1212.4	5.8973e+2	972.2	0.0	0.1	0.2	1.9	0.3	3.4
2	24.0	256	ExHy	28.	5.1201e+2	-28.6	6.6927e-1	-921.4	4.5725e+2	892.8	0.0	0.2	0.2	2.4	0.5	4.7
2	24.0	128	ExHy	28.	4.9467e+2	26.6	9.7175e-1	-771.2	4.0490e+2	797.8	0.0	0.8	0.2	1.6	0.3	3.0
2	24.0	64	ExHy	28.	5.0064e+2	42.6	1.3076e+0	-657.9	4.5872e+2	700.5	0.5	2.5	0.3	2.8	1.0	9.8
2	24.0	32	ExHy	28.	3.7409e+2	-33.2	1.6845e+0	-676.6	3.0825e+2	643.4	0.3	4.1	0.4	4.5	0.2	2.0
2	24.0	16	ExHy	28.	5.1261e+2	-515.1	2.5315e+0	-562.5	5.1254e+2	47.4	0.2	2.1	0.2	2.1	0.1	1.4
2	30.0	8192	ExHy	4.5	1.0969e+3	-1667.4	2.9457e-1	-2325.8	3.3851e+2	658.4	1.9	15.6	6.9	69.6	11.6	108.7
2	30.0	4096	ExHy	8.	7.8682e+2	-1051.9	2.9363e-1	-1843.0	3.5059e+2	791.1	0.1	0.8	0.7	8.2	1.2	11.6
2	30.0	2048	ExHy	15.	6.1638e+2	-662.2	3.2983e-1	-1574.8	3.4105e+2	912.7	0.1	0.8	0.7	10.1	1.8	16.8
2	30.0	1024	ExHy	22.	4.7630e+2	-287.8	3.9858e-1	-1263.9	2.7891e+2	976.0	0.1	0.5	0.2	5.8	0.5	5.5
2	30.0	512	ExHy	28.	3.6720e+2	-16.6	4.7574e-1	-1008.9	2.3272e+2	992.4	0.2	1.4	0.3	4.1	0.3	3.7
2	30.0	256	ExHy	30.	3.0297e+2	93.6	6.4638e-1	-821.1	1.7164e+2	914.7	0.1	0.9	0.1	1.5	0.3	2.9
2	30.0	128	ExHy	30.	2.6245e+2	97.7	8.5108e-1	-715.2	1.4859e+2	812.9	0.2	0.8	0.3	2.6	0.3	2.8
2	30.0	64	ExHy	30.	2.5341e+2	83.7	1.0888e+0	-632.8	1.6928e+2	716.5	0.1	1.7	0.7	6.1	0.6	5.9
2	30.0	32	ExHy	30.	1.8666e+2	38.9	1.3951e+0	-653.1	1.1188e+2	691.9	0.3	1.1	0.7	6.5	0.7	7.9
2	30.0	16	ExHy	30.	2.4393e+2	-518.6	2.0950e+0	-565.6	1.6947e+2	47.0	0.4	3.7	0.6	5.0	0.5	2.5
2	36.0	8192	ExHy	4.5	1.3909e+3	-1630.5	2.9845e-1	-2231.7	5.3027e+2	601.2	0.8	11.3	5.5	55.1	9.0	82.0
2	36.0	4096	ExHy	8.	9.9495e+2	-1050.9	2.8522e-1	-1824.2	5.9415e+2	773.2	0.1	0.7	0.9	7.3	1.5	15.3
2	36.0	2048	ExHy	15.	7.8571e+2	-666.0	3.2131e-1	-1533.9	5.8395e+2	867.9	0.0	0.4	0.6	5.8	1.1	11.6
2	36.0	1024	ExHy	22.	6.0881e+2	-289.9	3.8106e-1	-1231.6	4.9855e+2	941.8	0.0	0.6	0.5	5.2	0.6	7.2
2	36.0	512	ExHy	27.	4.6744e+2	-17.8	4.5015e-1	-990.5	4.2120e+2	972.7	0.1	0.6	0.2	2.6	0.5	4.0
2	36.0	256	ExHy	29.	3.8347e+2	91.5	6.0522e-1	-811.7	3.1365e+2	903.2	0.1	0.3	0.3	2.7	0.5	4.6
2	36.0	128	ExHy	30.	3.3563e+2	98.6	8.1093e-1	-701.4	2.6766e+2	800.0	0.1	2.1	0.3	2.3	0.5	5.1
2	36.0	64	ExHy	30.	3.2922e+2	81.2	1.0407e+0	-624.5	3.1273e+2	705.6	0.8	4.6	0.9	9.4	1.6	15.7
2	36.0	32	ExHy	30.	2.4422e+2	51.8	1.3326e+0	-636.9	2.0992e+2	688.7	0.7	3.2	0.5	4.4	0.4	4.5
2	36.0	16	ExHy	30.	3.0535e+2	-528.8	1.9452e+0	-564.6	3.0804e+2	35.8	0.3	1.7	0.4	2.4	0.2	1.1
2	42.0	8192	ExHy	4.5	1.2131e+3	-471.6	2.7422e-1	-1113.9	4.7775e+2	642.3	1.1	13.6	5.0	56.3	7.8	81.0
2	42.0	4096	ExHy	8.	9.0781e+2	-488.6	2.8341e-1	-1179.7	5.0099e+2	691.1	0.1	0.8	1.7	27.3	2.6	27.9
2	42.0	2048	ExHy	15.	7.2021e+2	-405.1	3.0157e-1	-1169.1	5.5699e+2	764.0	0.0	0.5	0.4	5.5	0.7	7.0
2	42.0	1024	ExHy	22.	5.7228e+2	-168.										

GDP DATA PROCESSING MANUAL

Sample .Z-file

```

$ DATE = 91-01-02
$ ASPACE= 183.0m
$ ZPLOT: DATA= FLOG
/* 29 Jul 93
AMTAVG 7.20 Contour file.
Cl Cn Ce Ns Nd Yl Plot file 1
1 5 0 3 1 1
CSAMT SURVEY DATA
CAGNIARD RESISTIVITY
values in ohm-meters
IIxxxxxxxxYYYYYYYzzzzzzzzzzz 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
2 0.0 17.00 1.359E+02
2 0.0 16.00 1.237E+02
2 0.0 15.00 1.362E+02
2 0.0 14.00 1.002E+02
2 0.0 13.00 1.930E+02
2 6.0 22.00 2.914E+02
2 6.0 21.00 2.482E+02
2 6.0 20.00 2.235E+02
2 6.0 19.00 1.777E+02
2 6.0 18.00 1.477E+02
2 6.0 17.00 1.187E+02
2 6.0 16.00 1.063E+02
2 6.0 15.00 1.143E+02
2 6.0 14.00 8.038E+01
2 6.0 13.00 1.217E+02
2 12.0 22.00 4.450E+02
2 12.0 21.00 4.544E+02
2 12.0 20.00 4.193E+02
2 12.0 19.00 3.519E+02
2 12.0 18.00 2.940E+02
2 12.0 17.00 2.397E+02
2 12.0 16.00 2.220E+02
2 12.0 15.00 2.552E+02
2 12.0 14.00 1.846E+02
2 12.0 13.00 3.643E+02
2 18.0 22.00 6.940E+02
2 18.0 21.00 5.455E+02
2 18.0 20.00 4.727E+02
2 18.0 19.00 3.829E+02
2 18.0 18.00 3.113E+02
2 18.0 17.00 2.427E+02
2 18.0 16.00 2.161E+02
2 18.0 15.00 2.486E+02
2 18.0 14.00 1.663E+02
2 18.0 13.00 2.701E+02
2 24.0 22.00 1.174E+03
2 24.0 21.00 9.179E+02
2 24.0 20.00 8.587E+02
2 24.0 19.00 7.323E+02
2 24.0 18.00 5.897E+02
2 24.0 17.00 4.572E+02
2 24.0 16.00 4.049E+02
2 24.0 15.00 4.587E+02
2 24.0 14.00 3.082E+02
2 24.0 13.00 5.125E+02
2 30.0 22.00 3.385E+02
2 30.0 21.00 3.506E+02
2 30.0 20.00 3.411E+02
2 30.0 19.00 2.789E+02
2 30.0 18.00 2.327E+02
2 30.0 17.00 1.716E+02
2 30.0 16.00 1.486E+02
2 30.0 15.00 1.693E+02
2 30.0 14.00 1.119E+02
2 30.0 13.00 1.695E+02
2 36.0 22.00 5.303E+02
2 36.0 21.00 5.941E+02
2 36.0 20.00 5.839E+02
2 36.0 19.00 4.985E+02
2 36.0 18.00 4.212E+02
2 36.0 17.00 3.136E+02
2 36.0 16.00 2.677E+02
2 36.0 15.00 3.127E+02
2 36.0 14.00 2.099E+02
2 36.0 13.00 3.080E+02
2 42.0 22.00 4.778E+02
2 42.0 21.00 5.010E+02
2 42.0 20.00 5.570E+02
2 42.0 19.00 5.164E+02
2 42.0 18.00 4.019E+02
2 42.0 17.00 3.271E+02
2 42.0 16.00 2.926E+02
2 42.0 15.00 3.265E+02
2 42.0 14.00 2.385E+02
2 42.0 13.00 2.773E+02
2 48.0 22.00 1.861E+02
2 48.0 21.00 2.493E+02
2 48.0 20.00 2.609E+02
2 48.0 19.00 2.383E+02
2 48.0 18.00 1.991E+02
2 48.0 17.00 1.558E+02
2 48.0 16.00 1.364E+02
2 48.0 15.00 1.512E+02
2 48.0 14.00 1.209E+02
2 48.0 13.00 9.585E+01
9999.00
Cl Cn Ce Ns Nd Yl Plot file 2
0 10 3 3 0 1
CSAMT SURVEY DATA
IMPEDANCE PHASE
values in milliradians
IIxxxxxxxxYYYYYYYzzzzzzzzzzz AAA
2 0.0 22.00 7.683E+02
2 0.0 21.00 8.424E+02
2 0.0 20.00 8.926E+02
2 0.0 19.00 9.250E+02
2 0.0 18.00 9.163E+02
2 0.0 17.00 8.563E+02
2 0.0 16.00 7.528E+02
2 0.0 15.00 6.903E+02
2 0.0 14.00 5.264E+02
2 0.0 13.00 8.100E+01
2 6.0 22.00 9.250E+02
2 6.0 21.00 9.167E+02
2 6.0 20.00 9.766E+02
2 6.0 19.00 9.823E+02
2 6.0 18.00 9.575E+02
2 6.0 17.00 8.879E+02
2 6.0 16.00 8.023E+02
2 6.0 15.00 7.229E+02
2 6.0 14.00 6.710E+02
2 6.0 13.00 1.042E+02
2 12.0 22.00 7.303E+02
2 12.0 21.00 7.981E+02
2 12.0 20.00 9.218E+02
2 12.0 19.00 9.493E+02
2 12.0 18.00 9.339E+02
2 12.0 17.00 8.540E+02
2 12.0 16.00 7.401E+02
2 12.0 15.00 6.708E+02
2 12.0 14.00 5.304E+02
2 12.0 13.00 5.733E+01
9999.00
*** end of file ***

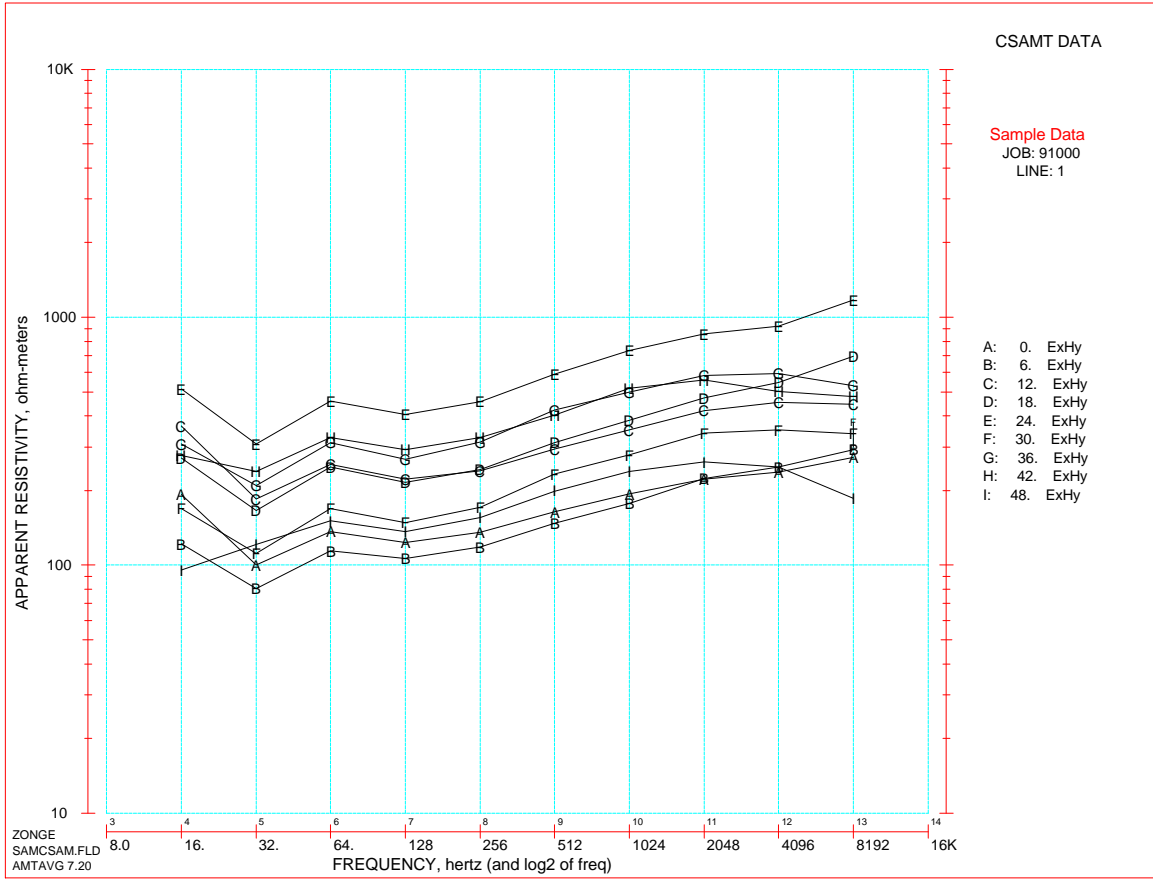
```

continued ...

continued ...

Sample .Xnn-file

SAMCSAM.X01



## Appendix C ... FILE DOCUMENTATION

### .AL-File DOCUMENTATION

SAMCSAM.AL File created by AMTAVG

The .AL-file consists of a section listing each data block for one station, sorted by frequency and block number. The following sections include block-average statistics and average values. The section headers include the component pair being averaged (usually ExHy), the averaging method (REAL, IMAGINARY is default, but ARITHMETIC was selected), and the Transmitter Current value to which E- and H-field data are normalized (1.0 amps is default).

### DATA BLOCK SUMMARY

PROJECT: Sample Data				File: "SAMCSAM.FLD "				CSAM0516, AMTAVG: 7.20								
LINE: 1	STATION: 0.	Tx: 1.	A-Sp: 183.0m	29 Jul 93	ARITHMETIC average											
Pair: "ExHy"	==ME==MAGNITUDE==MH==	CRNT	Coil	==PE=PHZ=PH==	==RHO=GDP=PD==	==RHO=CALC=PHZ=										
Blk	Stks	(uV) g	(pT) g	amps	(mR) pi (mR) pi	(o-m) (mR)	(o-m) (mR)									
f= 8192 Hz =																
405	16384	965.50	9	1.584	8	4.5	30	1491	0	713	0	271.0	778	271.0	778	1
406	16384	962.48	9	1.570	8	4.5	30	1493	0	717	0	274.1	776	274.1	776	1
407	16384	970.24	9	1.592	8	4.5	30	1488	0	738	0	270.7	751	270.7	751	1
f= 4096 Hz =																
408	16384	1253.8	10	3.134	9	8.0	30	2088	0	1253	0	233.3	834	233.3	834	1
409	16384	1253.8	10	3.126	9	8.0	30	2087	0	1246	0	234.5	842	234.5	842	1
410	16384	1255.0	10	3.092	9	8.0	30	2087	0	1237	0	240.2	850	240.2	850	1
411	16384	1263.9	10	3.128	9	8.0	30	2086	0	1243	0	238.0	844	238.0	844	1

→ GDP data acquisition frequency

→ .RAW-file data block number

→ GDP stacks acquired

→ E-channel magnitude, uV

→ E-channel gains

→ H-channel magnitude, pT

→ H-channel gains

← Transmitter current, amps

← Magnetic Coil ID

← E-channel phase, mR

← E-channel polarity flipped (0:no, 1:yes)

← H-channel phase, mR

← H-channel polarity flipped (0:no, 1:yes)

← GDP calculated Apparent Resistivity, m

← GDP calculated Impedance Phase, mR

← AMTAVG calculated Apparent Resistivity, m

← AMTAVG calculated Impedance Phase, mR

← Average flag (0: no, 1: yes)

BLOCK AVERAGE STATISTICS

PROJECT: Sample Data		MagNorm= 1.0 amps				CSAM0516, AMTAVG: 7.20				
LINE: 1	STATION: 0.	Tx: 1.	A-Sp: 183.0m		29 Jul 93	ARITHMETIC average				
STATISTICS	Pair:"ExHy"	E---MAGNITUDE---H	E---MAG---H	*PARAMETER RHO *	*COMPONENT RHO *					
Hz		(sigma)	(sigma)	(C-var)	(C-var)	(sigma)	(C-var)	(sigma)	(C-var)	
8192		0.005	0.003	0.4	0.7	1.875	0.7	4.482	1.6	
4096		0.003	0.002	0.4	0.6	3.152	1.3	3.416	1.4	
2048		0.008	0.005	1.1	1.2	0.193	0.1	7.305	3.3	
1024		0.005	0.006	1.0	1.2	0.757	0.4	5.840	3.0	

STANDARD DEVIATION ( $\sigma$ )		COEFFICIENT OF VARIATION (%)									
E-channel magnitude	$\leftarrow$	$\sigma$	$\leftarrow$	%	$\leftarrow$	%					
H-channel magnitude	$\leftarrow$	$\sigma$	$\leftarrow$	%							
Parametric Resistivity	$\leftarrow$	$\sigma$	$\leftarrow$	%							
Component Resistivity	$\leftarrow$	$\sigma$	$\leftarrow$	%							

AVERAGE DATA SECTION

AVERAGE ME--MAGNITUDE--MH	E---MAGNITUDE---H	E--PHASE--H	*PARAMETER AVG.*	*COMPONENT AVG.*						
Hz	(uV)	(pT)	nV/(Ma)	pTesla/a	(mR)	(mR)	RHO(o-m)	PHZ(mR)	RHO(o-m)	PHZ(mR)
8192	966.07	1.582	1173.1	0.351	1491.	723.	271.91	768.	271.95	768.
4096	1256.6	3.120	858.35	0.390	2087.	1245.	236.49	842.	236.48	842.
2048	1846.8	6.692	672.79	0.446	2450.	1558.	222.09	893.	222.09	893.
1024	2201.4	12.079	546.80	0.549	2809.	1884.	193.72	925.	193.72	925.

Average E-channel magnitude, $\mu$ V		Average H-channel magnitude, pT									
Average E-field magnitude	$\leftarrow$		$\leftarrow$								
Average H-field magnitude, pTesla/a	$\leftarrow$										
Average E-field phase, mR	$\leftarrow$										
Average H-field phase, mR	$\leftarrow$										

Average Parametric Resistivity, $\Omega$ m	$\leftarrow$										
Average Parametric Impedance Phase, mR	$\leftarrow$										
Average Component Resistivity, $\Omega$ m	$\leftarrow$										
Average Component Impedance Phase, mR	$\leftarrow$										



**CALCULATIONS for SAMCSAM.AL FILE**

NOTE: the following calculation examples use data from block 402, station 0.0 in the SAMCSAM.RAW file.

Values used in the calculations are from the .RAW-file, and may yield slightly less precise values than those calculated by the GDP or by the AMTAVG program.

**From Block 402 in .RAW-file:**

$$\begin{aligned} \text{MAG}_e &= 965.50 \mu \text{ Volts} = .96550 \mu \text{ Volts} \\ \text{MAG}_h &= 1.5836 \mu \mu \text{ Tesla} = 1.5836 \text{ pTesla} \\ \text{ASP}_{\text{km}} &= \text{ASP}_m / 1000. = 183. / 1000. = 0.183 \text{ km} \end{aligned}$$

**Calculation of Resistivity (RHO) [performed by GDP]:**

$$\begin{aligned} \text{Rho} &= \left( \frac{\text{Mag}_e}{\frac{\text{ASP}_{\text{km}}}{\text{Mag}_h}} \right)^2 * \frac{1}{5 * \text{FREQ}_{\text{Hz}}} * 10^6 \\ &= \left( \frac{.96550}{\frac{0.183}{1.5836}} \right)^2 * \frac{1}{5 * 8192.} * 10^6 \\ \text{Rho} &= 271.0 \Omega\text{m} \end{aligned}$$

**Calculation of Impedance Phase (IP) [performed by GDP]:**

$$\begin{aligned} \text{PHZ}_e &= 1.491.2 \text{ mRadians (mRad)} \\ \text{PHZ}_h &= 712.8 \text{ mRad} \end{aligned}$$

$$\text{IP} = \text{PHZ}_e - \text{PHZ}_h$$

$$\text{IP} = 1491.2 - 712.8$$

$$\text{IP} = 778.4 \text{ mRad}$$

**NOTE: Many values calculated by the GDP are recalculated by AMTAVG to allow for corrections in various parameters. (such as A-Spacing and transmitter current.)**

**Examples: .AL-file STATISTICS CALCULATIONS**

NOTE: the following calculation examples use data from 8192 Hz values at station 0.0 in file SAMCSAM.RAW.

**Standard Deviation ( $\sigma$ ) - general formula:**

$$\sigma = \sqrt{\frac{A - (N * B)}{N - 1}}$$

where A = sum of values, squared

B = average value, squared

N = number of values

**NOTE: although AMTAVG recalculates E- and H-field values, these are the .RAW-file values.****Standard Deviation for E-field ( $\sigma_e$ ):**For 8192 Hz:  $E_1 = 965.50\text{uV}/183.\text{m} * 4.5\text{a} = 1.1724 \text{ mV/Km} * \text{a}$ 

$$E_2 = 962.48 / 183. * 4.5 = 1.1688$$

$$E_3 = 970.24 / 183. * 4.5 = 1.1782$$

$$A = 1.1724^2 + 1.1688^2 + 1.1782^2 = 4.1288$$

$$B = [(1.1724 + 1.1688 + 1.1782) / 3]^2 = 1.3762$$

$$N = 3$$

$$\sigma_e = \sqrt{\frac{4.1288 - 3 * 1.3762}{3 - 1}}$$

$$\sigma_e = .00474 \approx .005$$

**Standard Deviation for H-Field ( $\sigma_h$ ):**For 8192 Hz:  $H_1 = 1.5836 \text{ pT}/4.5\text{a} = .35191 \text{ pT/a}$ 

$$H_2 = 1.5697 / 4.5 = .34882$$

$$H_3 = 1.5922 / 4.5 = .35382$$

$$A = .35191^2 + .34882^2 + .35382^2 = .37071$$

$$B = [(.35191 + .34882 + .35382) / 3]^2 = .12357$$

$$N = 3$$

$$\sigma_e = \sqrt{\frac{.37071 - 3 * .12357}{3 - 1}}$$

$$\sigma_e = .00252 \approx .003$$

**Coefficient of Variation (C-var) - general formula:**

C – var = % variation in magnitudes at each frequency.

$$= 100 * \frac{\sigma}{A}$$

where  $\sigma$  = standard deviation

A = arithmetic average

**Coefficient of Variation for E-field (C-var<sub>e</sub>):**

$$\sigma_e = 0.0048$$

$$A = E = 1.1731 \text{ mV/Km} * a$$

$$C - \text{var}_e = 100 * \frac{0.0048}{1.1731} = 0.4092$$

$$C - \text{var}_e \approx 0.4$$

\* similar calculation for C - var<sub>h</sub> using  $\sigma_h$  and average H - magnitude (H).

**Standard Deviation for Parameter RHO ( $\sigma_{\text{rhoP}}$ )**

$$\sigma_{\text{rhoP}} = \sqrt{\frac{A - (N * B)}{N - 1}}$$

$$A = 271.0^2 + 274.1^2 + 270.7^2 = 221,850.3$$

$$B = [(271.0 + 274.1 + 270.7)/3]^2 = 73,947.7$$

$$N = 3$$

$$\sigma_{\text{rhoP}} = \sqrt{\frac{221,850.3 - 3 * 73,947.7}{3 - 1}} = 1.8824$$

$$\sigma_{\text{rhoP}} \approx 1.882$$

**Coefficient of Variation for Parameter RHO (C-var<sub>rhoP</sub>)**

$$C - \text{var}_{\text{rhoP}} = 100 * \frac{\sigma_{\text{rhoP}}}{A} = 100 * \frac{1.8824}{271.93} = .6922$$

$$C - \text{var}_{\text{rhoP}} \approx 0.7$$

**Standard Deviation for Component RHO ( $\sigma_{\text{rhoC}}$ ):**

$$\sigma_{\text{rhoC}} = 2 * \text{rhoC} * \sqrt{(B_e + B_h)}$$

where rhoC = resistivity calculated from averaged components.

E = average E - field magnitude

H = average H - field magnitude

$$B_e = \left[ \frac{\sigma_e}{E} \right]^2$$

$$B_h = \left[ \frac{\sigma_h}{H} \right]^2$$

from above:=

$$\text{rhoC} = 271.95$$

$$E = 1.1731 \text{ mV/Km} * a \quad H = 0.35152 \text{ pT/a}$$

$$\sigma_e = 0.00474 \quad \sigma_h = .00252$$

$$B_e = \left[ \frac{.00474}{1.1731} \right]^2 = 16.346e - 6$$

$$B_h = \left[ \frac{.00252}{.35152} \right]^2 = 51.393e - 6$$

$$\sigma_{\text{rhoC}} = 2 * 271.95 * \sqrt{(16.346e - 6 + 51.393e - 6)} = 4.4758$$

$$\sigma_{\text{rhoC}} \approx 4.476$$

**Coefficient of Variation for Component RHO (C-var<sub>rhoC</sub>)**

$$C - \text{var}_{\text{rhoC}} = 100 * \frac{\sigma_{\text{rhoC}}}{\text{rhoC}}$$

From .AL - file:=

$$\sigma_{\text{rhoC}} = 4.4758$$

$$\text{rhoC} = 271.95$$

$$C - \text{var}_{\text{rhoC}} = 100 * \frac{4.4758}{271.95} = 1.6458$$

$$C - \text{var}_{\text{rhoC}} \approx 1.6$$

**Examples: .AL-file AVERAGE CALCULATIONS****Average Magnitude values (MAG<sub>avg</sub>)**

(RAW, E-, or H-field magnitude values)

$$\text{MAG}_{\text{avg}} = \frac{\text{MAG}_1 + \text{MAG}_2 + \dots + \text{MAG}_n}{n}$$

$$E_n = \text{MAG}_n / \text{A-Spacing} * \text{TxCurr}$$

$$\begin{aligned} \text{For } 8192 \text{ Hz: } \text{MAG}_1 &= 965.50 \text{ } \mu\text{V} && (\text{block } 402) \\ \text{MAG}_2 &= 962.48 && (\text{block } 403) \\ \text{MAG}_3 &= 970.24 && (\text{block } 404) \end{aligned}$$

$$\begin{aligned} E_1 &= 965.50 \text{ } \mu\text{V} / 183.\text{m} * 4.5\text{a} = 1.1724 \text{ mV/Km*a} \\ E_2 &= 962.48 \quad / 183. \quad * 4.5 = 1.1688 \\ E_3 &= 970.24 \quad / 183. \quad * 4.5 = 1.1782 \end{aligned}$$

$$\text{MAG}_{\text{avg}} = \frac{1.1724 + 1.1688 + 1.1782}{3}$$

$$\text{MAG}_{\text{avg}} = 1.1731 \text{ mV/Km} * \text{a}$$

**Average Phase values (PHZ<sub>avg</sub>)**

(E-, H-field, or Impedance Phase values)

$$\text{PHZ}_{\text{avg}} = \frac{\text{PHZ}_1 + \text{PHZ}_2 + \dots + \text{PHZ}_n}{n}$$

$$\begin{aligned} \text{For } 8192 \text{ Hz: } \text{PHZ}_1 &= 1491.2 \text{ mRad} && (\text{block } 402) \\ \text{PHZ}_2 &= 1493.4 && (\text{block } 403) \\ \text{PHZ}_3 &= 1488.4 && (\text{block } 404) \end{aligned}$$

$$\text{PHZ}_{\text{avg}} = \frac{1491.2 + 1493.4 + 1488.4}{3}$$

$$\text{PHZ}_{\text{avg}} = 1491.0 \text{ mRad}$$

**Parameter Average RHO (RHO<sub>p</sub>):**

(RHO<sub>n</sub> are from each data block)

$$RHO_p = \frac{RHO_1 + RHO_2 + \dots + RHO_n}{n}$$

For 8192 Hz: RHO<sub>1</sub> = 271.0 Ωm (block 402)  
 RHO<sub>2</sub> = 274.1 (block 403)  
 RHO<sub>3</sub> = 270.7 (block 404)

$$RHO_p = \frac{271.0 + 274.1 + 270.7}{3}$$

$$RHO_p = 271.9 \text{ } \Omega\text{m}$$

**Parameter Average PHZ (PHZ<sub>p</sub>):**

(PHZ<sub>n</sub> are from each data block)

$$PHZ_p = \frac{PHZ_1 + PHZ_2 + \dots + PHZ_n}{n}$$

For 8192 Hz: PHZ<sub>1</sub> = 778.4 mRad (block 402)  
 PHZ<sub>2</sub> = 776.2 (block 403)  
 PHZ<sub>3</sub> = 750.6 (block 404)

$$PHZ_p = \frac{778.4 + 776.2 + 750.6}{3}$$

$$PHZ_p = 768.4 \text{ mRad}$$

**Component Average RHO (RHO<sub>c</sub>):**

(E<sub>MAG</sub> and H<sub>MAG</sub> are averaged values)

$$RHO_c = \left( \frac{E_{MAG}}{H_{MAG}} \right)^2 * \frac{1}{5 * FREQ_{Hz}} * 10^6$$

$$E_{MAG} \text{ (mV/Km*amp)} = MAG_e / (A\text{-Spacing} * TxCurr)$$

$$H_{MAG} \text{ (pTesla/amp)} = MAG_h / TxCurr$$

$$= \left( \frac{1.1731}{.35152} \right)^2 * \frac{1}{5 * 8192} * 10^6$$

$$RHO_c = 271.9 \text{ } \Omega\text{m}$$

**Component Average PHZ (PHZ<sub>c</sub>):**

Same as Parameter Average PHZ (PHZ<sub>p</sub>).

### **AMTAVG .AL-file data listings**

Description of data listings from AMTAVG 7.xx programs.

One CSAMT measurement is represented by one line (record) in a .FLD-file, the input file format for AMTAVG. One measurement consists of data from a pair of GDP E- and H-field channels.

The following values are listed for each measurement: E-channel magnitude and gain, H-channel magnitude and gain, current, coil number, E-field phase and polarity flag, H-field phase and polarity flag, GDP calculated RHO and PD, AMTAVG calculated RHO and PD, and averaging flag.

Measurements are listed by frequency (high to low) and block number.

### **AVERAGED DATA LISTING**

E- and H-channel magnitudes are averaged. These values have not been normalized by current.

For each E- and H-channel magnitude, the E- and H-field magnitudes are calculated and averaged. The magnitudes have been normalized by current, whose value is listed in the header.

The E- and H-channel phase values are averaged. When the "phase-referencing" mode has been selected in AMTAVG, individual values will be adjusted by  $2\pi$  so that each value is within  $\pm \pi$  of the first value accumulated at one frequency.

The RHO and PD values recalculated by AMTAVG for each measurement are averaged. The results are included under PARAMETER AVG.

The average E- and H-field magnitudes are used to calculate COMPONENT AVG RHO values. The average E- and H-field phase values are used to calculate the COMPONENT AVG PHZ values.

COMPONENT AVG RHO values should be equal to pseudosection RHO values. The averaging by components should result in values that are less noisy than those values on the field pseudosection, unless the noise was synchronous instead of random.

**ADDITIONAL NOTES**

Standard deviation values are calculated during the averaging of E-and H-field magnitudes, and for PARAMETER AVG RHO. They are displayed in the columns labelled "(sigma)". The coefficients of variation are also calculated and displayed in the columns labelled "(C-var)".

Standard Deviation for arithmetically averaged values:

$$\begin{aligned} A &= \text{sum of values-squared} \\ B &= \text{average-value-squared} \\ N &= \text{number of values} \\ S &= \text{Sqrt} [ ( A - N * B ) / ( N - 1 ) ] \end{aligned}$$

Standard Deviation for component averaged resistivity values:

$$\begin{aligned} S_e &= \text{standard deviation for E-magnitudes} \\ S_h &= \text{standard deviation for H-magnitudes} \\ A_e &= \text{average-E-magnitude} & A_h &= \text{average-H-magnitude} \\ B_e &= ( S_e / A_e ) \text{ squared} & B_h &= ( S_h / A_h ) \text{ squared} \\ R_a &= \text{Apparent Resistivity (from averaged components)} \\ S_p &= 2 * R_a * \text{Sqrt} [ B_e + B_h ] \end{aligned}$$

Coefficients of Variation:

$$\begin{aligned} S &= \text{standard deviation} \\ A &= \text{arithmetic average} \\ V &= 100 * S / A \end{aligned}$$

Previous methods for evaluating the COMPONENT AVG RHO value often indicate the component avg to be noisier than the parametric avg, when it is expected to be less noisy at all times. The appearance results from the variation in E and H separately, which may be significant. The RHO values depend upon the E/H ratio, with E and H values varying in a similar manner. The E/H ratio is a measure of the noise, while the variation of E or H includes system changes.

Note: Where a value is undefined, the location where it would be expected to appear is left blank.

See HELPZ file on Phase Calculations Performed by AMTAVG and AMTRED (AMTPHASE.hep) for a discussion of the method used to adjust phase values to be as uniform as possible ("Phase Referencing"). This procedure is no longer used by default, due to the corrections resulting from averaging by Real and Imaginary components.



**.AD-File Example**

```

1:From AMTAVG 7.20: "SAMCSAM.AD " v4.0                      GDP AMT 0516
2:/* Data for components ExHy
3:/* 29 Jul 93
4:Client : ZONGE ENGINEERING
5:Project: Sample Data
6:Line   : 1
7:Grid used : 1000 meter Universal Transverse Mercator grid, zone 12
8:Grid north:   North      Grid scale:      1.00 m / grid unit.
9: Tn   TX 1     East      5000 ft      Xc           Yc           Zc
10: Rn    0.0    East      183.0m AP1 Xc           Yc           Zc
11:  F23.1  8192 Hz Em 1.1731E-03 Ep 1.4910E+00 Hm 3.5150E-07 Hp 7.2268E-01
12:  F22.1  4096 Hz Em 8.5835E-04 Ep 2.0870E+00 Hm 3.9003E-07 Hp 1.2447E+00
13:  F21.1  2048 Hz Em 6.7279E-04 Ep 2.4504E+00 Hm 4.4613E-07 Hp 1.5578E+00
14:  F20.1  1024 Hz Em 5.4680E-04 Ep 2.8091E+00 Hm 5.4905E-07 Hp 1.8841E+00
15:  F19.1   512 Hz Em 4.3143E-04 Ep 3.0870E+00 Hm 6.6498E-07 Hp 2.1707E+00
16:  F18.1   256 Hz Em 3.6102E-04 Ep-3.0655E+00 Hm 8.6567E-07 Hp 2.3613E+00
17:  F17.1   128 Hz Em 3.1513E-04 Ep-3.0565E+00 Hm 1.1202E-06 Hp 2.4738E+00
18:  F16.1    64 Hz Em 2.9184E-04 Ep-3.0730E+00 Hm 1.3978E-06 Hp 2.5199E+00
19:  F15.1    32 Hz Em 2.3443E-04 Ep 3.0153E+00 Hm 1.8517E-06 Hp 2.4889E+00
20:  F14.1    16 Hz Em 3.4135E-04 Ep 2.6973E+00 Hm 2.7474E-06 Hp 2.6163E+00
    
```

**DOCUMENTATION OF VALUES BY LINE NUMBER:**

**LINE:**

**EXPLANATION:**

- 1: **From AMTAVG 7.20** Name and version number of program which generated this .AD-file
- "SAMCSAM.AD "** Name of .AD-file
- GDP AMT 0516** GDP program name and version number used to collect data
- 4: **Client :** Client label from Mode CLIENT
- 5: **Project:** Project label from Mode PROJECT
- 6: **Line :** Line label from Mode JOBLINE
- 7: **Grid used :** Plan map grid information; may also be a client-defined grid using any units
- 8: **Grid north:** Grid parameter relating grid to true north
- Grid scale:** Scaling factor for grid units, meters/unit
- 9: **Tn TX 1** Transmitter name (TX 1)
- East** Transmitter orientation
- 5000 ft** Transmitter length (in feet if no unit designator)
- Xc, Yc, Zc** Transmitter planmap coordinates for line

*GDP DATA PROCESSING MANUAL*

10: <b>Rn 0.0</b>	Receiver name (station #) (0.0)
<b>East</b>	Receiver orientation
<b>183.0m</b>	A-Spacing, in meters
<b>AP1</b>	1st letter: raw data averaging method  A - arithmetic average S - square-mean-root
	2nd letter: RHO, IP calculation method  P - parametric C - component
	3rd letter: skip flag for this station A data processing method may or may not include a station based upon this flag  1 - use the station 0 - skip the station
<b>Xc, Yc, Zc</b>	Receiver planmap coordinates for station
11: <b>F23.1</b>	Frequency number (8192 Hz = $2^{13}$ , Fn= 13 + 10)
<b>8192 Hz</b>	Frequency, in hertz (frequencies below 1Hz may be expressed in fractional form)
<b>Em</b>	Average E-field magnitude, volts/(km*amp)
<b>Ep</b>	Average E-field phase, radians
<b>Hm</b>	Average H-field magnitude, microTesla/amp
<b>Hp</b>	Average H-field phase, radians

## **.AD-file V4.0 FORMAT DOCUMENTATION**

An .AD-file contains averaged CSAMT data for discrete and/or harmonic frequencies. The raw field data has been averaged, various plan map coordinates and parameters added, and transmitter data included. Files of this type are archived together with the raw data files (.RAW-file), and topographic data file (.TC-file). The .AD-file is used by programs that provide plot files, plots, and options for further processing.

A sequential file is used, with lines of up to 72 characters. Values that are not defined are left blank. The user (a person or program) is responsible for recognizing blank values as distinct from zero values. The file is to be read from top to bottom, with data for a transmitter applying to data for each receiver that follows, until data for another transmitter is read. In like fashion, data for a receiver dipole applies to all following data for frequencies, until data for another receiver is read.

Each file contains data for one survey line. Files may contain data for an entire area, if X,Y coordinates are used instead of a receiver label to define station location.

Compass directions are assumed to be entered as bearings (not azimuth), in capital letters, to the nearest degree, referring to true north unless otherwise specified. A line is defined to have a "bearing" in the direction of increasing station numbers, at that end of the line. A back "bearing" refers to the opposite direction, at the other end of the line. The line has an "orientation" defined as the "bearing" that is referenced to north. Directions of the transmit and receive dipoles are expected to be "orientations". By convention, N 00 E is used for lines oriented North-South, and N 90 E is used for lines oriented East-West.

The .AD-file may use a "normal" or an "extended" format. Lines that begin with " Dipole" or " Data" contain "extended" format data. In a "normal" format file these lines are not included.

Extended format files lines beginning with " Dipole" specify the grid locations of the ends of the dipole. Coordinates given on the first line refer to the center of the dipole (Xc,Yc,Zc). At this time, the end point coordinates are copied from the center coordinates. A future capability may calculate the X,Y coordinates, using the dipole orientation, length, center X,Y coordinates, and orientation of grid north. The elevations of the end points will continue to be copied from the center elevation.

Users of this data file should ignore any lines that are not defined here. Each line begins with unique characters in specific columns. Zonge Engineering provides for comment lines when the first column character is a double quote "". Also, a line with a dollar sign '\$' in the first column is expected to contain the name of a variable and a value to be assigned from within programs, in a manner similar to the FORTRAN NAMELIST. Comment or Variable lines may appear as lines added at any point in the file.

*GDP DATA PROCESSING MANUAL*

```

1:From AD-AD 1.40: "SAMCSAM.AD " (extended)                GDP AMT 0516
2:Client : ZONGE ENGINEERING
3:Project: Sample Data
4:Line   : 1
5:Grid used : 1000 meter Universal Transverse Mercator grid, zone 12
6:Grid north:      North      Grid scale:      1.00 m / grid unit.
7: Tn   TX 1      East   5000 ft      Xc          Yc          Zc
8:  Dipole                X1          Y1          Z1
9:  Dipole                X2          Y2          Z2
10: Rn   0.0      East   183.0m AP1 Xc          Yc          Zc
11:  Dipole                X1          Y1          Z1
12:  Dipole                X2          Y2          Z2
13: F23.1 8192 Hz Em 1.1731E-03 Ep 1.4910E+00 Hm 3.5150E-07 Hp 7.2268E-01
14:  Data                Ra 2.7193E+02 Pd 7.6832E-01 -- --
15: F22.1 4096 Hz Em 8.5835E-04 Ep 2.0870E+00 Hm 3.9003E-07 Hp 1.2447E+00
16:  Data                Ra 2.3648E+02 Pd 8.4230E-01 -- --
17: F21.1 2048 Hz Em 6.7279E-04 Ep 2.4504E+00 Hm 4.4613E-07 Hp 1.5578E+00
18:  Data                Ra 2.2209E+02 Pd 8.9260E-01 -- --
19: F20.1 1024 Hz Em 5.4680E-04 Ep 2.8091E+00 Hm 5.4905E-07 Hp 1.8841E+00
20:  Data                Ra 1.9371E+02 Pd 9.2500E-01 -- --
21: F19.1  512 Hz Em 4.3143E-04 Ep 3.0870E+00 Hm 6.6498E-07 Hp 2.1708E+00
22:  Data                Ra 1.6442E+02 Pd 9.1620E-01 -- --
23: F18.1  256 Hz Em 3.6102E-04 Ep-3.0655E+00 Hm 8.6567E-07 Hp 2.3613E+00
24:  Data                Ra 1.3588E+02 Pd-5.4268E+00 -- --
25: F17.1  128 Hz Em 3.1513E-04 Ep-3.0565E+00 Hm 1.1202E-06 Hp 2.4738E+00
26:  Data                Ra 1.2365E+02 Pd-5.5303E+00 -- --
27: F16.1   64 Hz Em 2.9184E-04 Ep-3.0730E+00 Hm 1.3978E-06 Hp 2.5199E+00
28:  Data                Ra 1.3622E+02 Pd-5.5929E+00 -- --
29: F15.1   32 Hz Em 2.3443E-04 Ep 3.0153E+00 Hm 1.8517E-06 Hp 2.4889E+00
30:  Data                Ra 1.0018E+02 Pd 5.2640E-01 -- --
31: F14.1   16 Hz Em 3.4135E-04 Ep 2.6973E+00 Hm 2.7474E-06 Hp 2.6163E+00
32:  Data                Ra 1.9296E+02 Pd 8.1000E-02 -- --

```

The first six lines should always occur, in the order specified, at the top of the file.

- 1: "From" specifies the program and version that created the file. The program name is up to six characters, four for version. The name of the file, when created, is specified in quotes, maximum of twelve characters. The file was written in extended format: in normal format the "(extended)" is omitted. The version of the GDP program is given at the end of the line.
- 2: Name of the client, in capital letters.
- 3: Name of the project, in upper and lower case letters.  
The maximum length of "client" and "project" is 30 characters.  
This file allows the entire line to be used.
- 4: Name of the survey line, six characters, alphanumeric. The Zonge convention is to quote numerals of one or two digits when used to label the survey line.
- 5: Text describing the grid used for specifying coordinates.  
This could be a client-defined grid, using any units.
- 6: Grid parameters, including the relationship of the grid to true north, and the scale in feet-per-unit or meters-per-unit. FORMAT(15X,A6,15X,F10.0,A2)

A transmitter specified at the top of the file relates to data for receivers that follow. Any number of transmit dipoles may be included in the file, located before the receiver(s) related to them. Data for two transmitters located one immediately after another result in the first not being applied to any receiver, and the second applying to all receivers that follow.

- 7: Tn= transmitter name, dipole orientation, length (ft or m), and X,Y plan map coordinates and Z elevation for the center of the dipole, in the units specified in line 6.  
FORMAT(4X,A10,1X,A6,F6.0,A2,7X,F10.0,3X,F10.0,3X,F10.0)
- 8: Extended format data for one end of the transmit dipole.

9: Extended format data for the other end of the dipole.

FORMAT(36X,F10.0,3X,F10.0,3X,F10.0)

Receiver data is included immediately prior to the data values given for each frequency, in the same format as transmitter data.

10: Rn= receiver name, dipole orientation, length (ft or m), and dipole center X,Y,Z coordinates. The dipole length is followed by the raw data averaging method. The first character is "A" for Arithmetic or "S" for Square-Mean-Root. The next character is "P" for Parametric (RHO and IP parameters calculated for each block of field data, which are then averaged) or "C" for Component (average of E- and H-field mag and phz, from which RHO and IP parameters are calculated). The third character is "0" or "1", for use by programs that may or may not include the station for further processing. ("1": use the station, "0": skip it.).

11: Receiver end point coordinates, same format as transmitter.

12: Receiver end point coordinates, same format as transmitter.

Frequency data include component values. Extended format files may contain additional values, such as RHO and IP. Any number of "Data" lines may be included. One is currently defined.

13: Frequency number (The integer portion minus 10 is the exponent-of-two for the fundamental frequency. The decimal portion times 10 is the harmonic number. F23.1 =  $2^{*}13 * 1 = 8192\text{Hz}$ ) (The GDP-12 uses frequency numbers, according to the thumbwheel setting that represents 1.Hz, typically 3 or 4)

Frequency (Hz), E-field magnitude (V/(KM\*A)) and phase (Rad), H-field magnitude (Tesla/Amp or KGamma/Amp) and phase (Rad)

Frequencies below 1.Hz may be specified as a fraction, not a lengthy decimal value: 1/32, 1/64, 1/128 Hz.

FORMAT(3X,I2,A10,4X,E11.0,3X,E11.0,3X,E11.0,3X,E11.0)

14: Additional values for the previous frequency line. RHO in ohmmeters, IP in radians, and two undefined positions.

#### NOTES CONCERNING CALIBRATION DATA

GDP data has had system and coil calibrates removed by the instrument. Data magnitudes are divided by the normalized magnitude for the appropriate channel and frequency. Calibrate phase values are subtracted from data phase values.

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

\ AMTAVG 7.20: "SAMCSAM.FLD", Dated 91-01-01, Processed 29 Jul 93  
 \ \$ ASPACE= 183.0m  
 \ \$ XMTR = 1.

skp	Station	Freq	Comp	Amps	Emag	Ephz	Hmag	Hphz	Resistivity	Phase	%Emag	sEphz	%Hmag	sHphz	%Rho	sPhz
2	0.0	8192	ExHy	4.5	1.1731e+3	1491.0	3.5150e-1	722.7	2.7195e+2	768.3	0.4	3.1	1.4	14.7	1.7	16.6
2	0.0	4096	ExHy	8.	8.5835e+2	2087.0	3.9003e-1	1244.7	2.3648e+2	842.4	0.4	3.1	0.9	7.1	1.4	12.9
2	0.0	2048	ExHy	15.	6.7279e+2	2450.4	4.4613e-1	1557.8	2.2209e+2	892.6	1.1	11.3	1.2	1.6	0.1	1.1
2	0.0	1024	ExHy	22.	5.4680e+2	2809.1	5.4905e-1	1884.1	1.9372e+2	925.0	1.0	6.0	1.2	7.5	0.4	3.5
2	0.0	512	ExHy	27.	4.3143e+2	3087.0	6.6498e-1	2170.8	1.6442e+2	916.3	0.0	1.4	0.1	0.6	0.2	1.8
2	0.0	256	ExHy	29.	3.6102e+2	-3065.5	8.6567e-1	2361.3	1.3588e+2	856.3	0.0	0.3	0.2	2.1	0.2	1.9
2	0.0	128	ExHy	30.	3.1513e+2	-3056.5	1.1202e+0	2473.8	1.2365e+2	752.8	0.1	0.6	0.3	3.3	0.3	2.8
2	0.0	64	ExHy	30.	2.9184e+2	-3073.0	1.3978e+0	2519.9	1.3621e+2	690.3	0.2	4.8	0.5	4.2	0.2	2.0
2	0.0	32	ExHy	30.	2.3443e+2	3015.3	1.8517e+0	2488.9	1.0018e+2	526.4	0.5	2.1	0.5	4.3	0.2	1.4
2	0.0	16	ExHy	30.	3.4135e+2	2697.3	2.7474e+0	2616.3	1.9295e+2	81.0	0.5	4.3	0.5	4.9	0.1	1.2
2	6.0	8192	ExHy	4.5	1.2513e+3	-2111.5	3.6216e-1	-3036.5	2.9142e+2	925.0	1.0	12.0	1.3	12.8	2.4	19.8
2	6.0	4096	ExHy	8.	8.5772e+2	-1267.2	3.8044e-1	-2183.9	2.4819e+2	916.7	0.2	3.0	0.7	8.3	1.2	12.0
2	6.0	2048	ExHy	15.	6.4934e+2	-785.8	4.2923e-1	-1762.4	2.2349e+2	976.6	0.1	1.1	0.4	4.3	0.5	3.2
2	6.0	1024	ExHy	22.	5.0469e+2	-373.3	5.2905e-1	-1355.6	1.7775e+2	982.3	0.1	0.4	0.1	1.7	0.2	2.0
2	6.0	512	ExHy	27.	3.9387e+2	-73.8	6.4048e-1	-1031.4	1.4772e+2	957.5	0.0	1.5	0.1	0.9	0.2	2.7
2	6.0	256	ExHy	29.	3.2680e+2	68.6	8.3859e-1	-819.4	1.1865e+2	887.9	0.1	0.4	0.1	0.9	0.3	2.8
2	6.0	128	ExHy	30.	2.8114e+2	92.6	1.0776e+0	-709.6	1.0635e+2	802.3	0.0	0.3	0.0	0.3	0.1	0.5
2	6.0	64	ExHy	30.	2.6778e+2	87.0	1.4003e+0	-635.9	1.1428e+2	722.9	0.1	1.1	0.3	2.5	0.2	2.2
2	6.0	32	ExHy	30.	2.0597e+2	-8.5	1.8163e+0	-679.5	8.0377e+1	671.0	0.1	1.4	0.2	1.7	0.2	1.9
2	6.0	16	ExHy	30.	2.6405e+2	-442.2	2.6760e+0	-546.5	1.2170e+2	104.2	0.3	4.6	0.2	2.2	0.5	1.2

**Skp**

skip flag

**Resistivity**

Cagniard Resistivity (Ohm-Meters)

**Station**

Receiver Station location

**Phase**

Impedance phase = (E-phase - H-phase) (milliRadians)

**Freq**

Frequency at which data was measured (Hertz)

**% Emag**

Statistical variation of magnitude values from averaged data blocks.  
 Standard Deviation/Average Emag (percent)

**Comp**

Components measured

**sEphz**

Statistical variation of the data blocks averaged for this data point.  
 100 \* Standard Deviation of Ephz values (milliradians)

**Amps**

Square-Wave current (amps)

**% Hmag**

Statistical variation of magnitude values from averaged data blocks.  
 Standard Deviation / Average Hmag (percent)

**Emag**

E-field magnitude  
 (microVolts/(kiloMeter\*Amp))

**sHphz**

Statistical variation of the data blocks averaged for this data point.  
 100 \* Standard Deviation of Hphz values (milliradians)

**Ephz**

E-field phase (milliRadians)

**% Rho**

Statistical variation of magnitude values from averaged data blocks.  
 Standard Deviation / Average Rho (percent)

**Hmag**

(milliGammas/Amp)

H-field magnitude (picoTesla/Amp)

**sPhz**

Statistical variation of the data blocks averaged for this data point.  
 100 \* Standard Deviation of Phase values (milliradians)

**Hphz**

H-field phase (milliRadians)

**.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: IIxxxxxxxxxYYYYYYYYzzzzzzzzzzz 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:**

- | <u>Line #</u>           | <u>Explanation:</u>  |
|-------------------------|--|
| 1: \$ 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<br>1 = logarithmic<br>2 = pseudo-log<br>Pseudo-log contours: positive and negative values contoured separately, using log10(abs(value)), plus a zero contour. |
| Cn                      | Label for number of contours per interval.   |
| Ce                      | Label for exponent of the contour interval.<br>The "interval" is an integer power of ten: 10 <sup>Ce</sup>   |
| Ns                      | Label for number of significant digits when posting values.<br>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<br>1 = linear frequency (log spacing)<br>2 = log frequency (linear spacing)<br>3 = linear depth  |
| 5: 1                    | Value of Cl: logarithmic contours  |
| 5                       | Value of Cn: 5 contours per "interval"   |
| 0                       | Value of Ce: interval = 10 <sup>0</sup> = 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 Electro-Magnetic 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.

**ffffff** - Frequency at which data was acquired.

**www** - Window number.

<b>II</b>	<b>xxxxxxxx</b>	<b>yyyyyyyy</b>	<b>zzzzzzzzzzzz</b>	<b>AAA</b>	<b>ffffff</b>	<b>www</b>
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