LPLOT
DOCUMENTATION

ZONGE Data Processing
CR and RPIP Data Processing Program
version 7.0x

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LPLOT Program Documentation

OVERVIEW

LPLOT provides "listing-format" (ASCII) pseudosections and plot files of parameters selected from an input .P-file. The selected data may also be viewed on screen while an output file is being written.

INPUT FILES

Data files read by LPLOT include an intermediate data file (.P-file) and optionally a mode file (.MDE-file).

The intermediate data file is provided by the CRRED CR/IP data processing program. The data file consists of several parameters and a data curve for each data point. The nature of the data curve is specified by CRRED, and may be the averaged data (same curve as included in the .S-file), a coupling curve specified by the GDPHM decoupling program, or a decoupled curve.

An optional mode file includes entries that modify mode values defined by Zonge DATPRO programs. A mode name is specified for several program variables that a user may wish to modify. Each line in a mode file includes the program name, mode name, and value. When running LPLOT, help text and mode descriptions are also available at the MODE prompt. This manual also includes a description for each variable that may be modified in LPLOT, and includes an appendix that describes modes in more detail.

OUTPUT FILES

The LPLOT listing file (.L-file) is a "listing-format" (text) pseudosection, suitable for printing. The file uses "FORTRAN" carriage-control characters, which reserve the first column. The Zonge utility program LISTF can be used to print these files.

The LPLOT program can be used to create plot files (.Z-files) with the users choice of parameters or curve data for use by the ZPLOT plot program which typically produces contoured pseudo-sections.

The content of .L- and .Z-files is specified by the user while running the LPLOT program. One or two values are extracted from the .P-file for each plot-point. These values may be a parameter such as Resistivity or 3-point Decoupled Phase. Or they may be one component and frequency from the data curve in the .P-file, such as the 0.125 Hz Real component of the Normalized Residual Electro-magnetic (REM) data curve.

SURVEY LOCATION CONVENTIONS

Zonge DATPRO programs assume that survey locations for the Dipole-Dipole configuration are entered by the GDP operator in a specific manner. First, the N-Spacing for each channel is entered. Then, the Tx and Rx entries indicate the dipoles for the channel with the SMALLEST N-Spacing. Also, Dipoles extend between two adjacent stations with the LOWEST numbered station entered for each dipole.

Station numbers are assumed to increase towards the north or east, and decrease towards the south or west (negative values when the station is south or west of the zero coordinate). Therefore, the Tx and Rx entries reflect the south or west end of each dipole.

COUPLING PARAMETERS

Averaged data is composed of various responses, some of which are useful. An IP response and multiple coupling responses are included, in addition to measurement noise. Coupling responses are due to the measurement configuration (Dipole-Dipole, for example) and geologic structure in addition to various cultural responses due to power lines, pipe lines, grounded metallic fences, railroads, and so on.

The GDPHM program is used when coupling responses need to be determined as much as possible. Theoretical data curves that approximate each type of coupling are generated. The parameters for these curves are iteratively adjusted until the remaining data is minimized. Ideally, all that remains is the measurement noise. The approximated data curve then consists of one or more theoretical coupling curves and a theoretical IP response. Remove the coupling curves from the averaged data and you are left with the actual IP response and measurement noise.

A different, more direct, approach may be useful when the geologic structure is horizontally layered and relatively simple, and cultural responses are minimal. CRRED will remove the homogeneous earth response (one of the forms of coupling), which leaves the Residual EM (REM) response. This response is usually normalized by frequency and N-Spacing, and can provide a pseudosection that amplifies the response from resistively inconsistent geologic units.

RESIDUAL ELECTROMAGNETIC (REM) DATA

Data gathered for the purpose of obtaining residual electro-magnetic (REM) data are total impedance measurements of the coupling between grounded transmitter and receiver dipoles on the surface of the earth. When a constant squarewave of current flows through the transmitter wire and into the ground, this signal is coupled to the receiver by two methods acting simultaneously. The signal that appears at the receiver dipole is a combination of direct current coupling and inductive or electro-magnetic coupling. Direct current coupling, referred to as ground coupling or ground response, is due to actual current flow through the ground from the transmitter dipole to the receiver dipole. Electro-magnetic coupling is induced signal in the receiver wire caused by the electro-magnetic field around the transmitter dipole.

Both of these kinds of coupling are always present in total impedance data, but the degree to which each is present varies with different geologic environments. The form and quantity of the ground response are functions of the rock type and pore fluid content. Metallic sulfide minerals and layer silicate minerals are notable producers of large ground responses. Inductive coupling for a given frequency over a homogeneous earth is a function largely of resistivity and array geometry (dipole lengths and relative dipole position). For a given frequency over a layered or otherwise inhomogeneous earth it is a function of array geometry, resistivity, depth and size of the layers and/or bodies in the subsurface. In higher resistivity hard rock environments the quantity of ground response is usually nearer to and sometimes greater than the inductive coupling which is decreased with increased resisitivity. Inversely, in lower resistivity sedimentary environments the ground response is usually small while inductive coupling dominates.

The method of obtaining REM data involves removing from the total impedance data two of the quantities known to present in all of the measurements, in order to allow effects from less prevalent sources to be more evident. First, direct current coupling or ground response is determined and removed from the total impedance data for the data station being analyzed. Two methods are available to remove the ground response. The standard ZONGE decoupling technique can be used to find the total inductive coupling present, automatically eliminating the ground response. This is relatively slow except for simple geologic situations, but it yields noise-free coupling data. A faster method is to perform a quadratic fit on the three (typical) lowest frequencies measured, extrapolate to zero frequency, and use the resulting value as the "coupling free" ground response. Employing knowledge of the ground response in similar areas, an estimated ground response for all the frequencies is formulated and removed from the measured total impedance data. This method works well for sedimentary environments where ground responses are small and reasonably predictable.

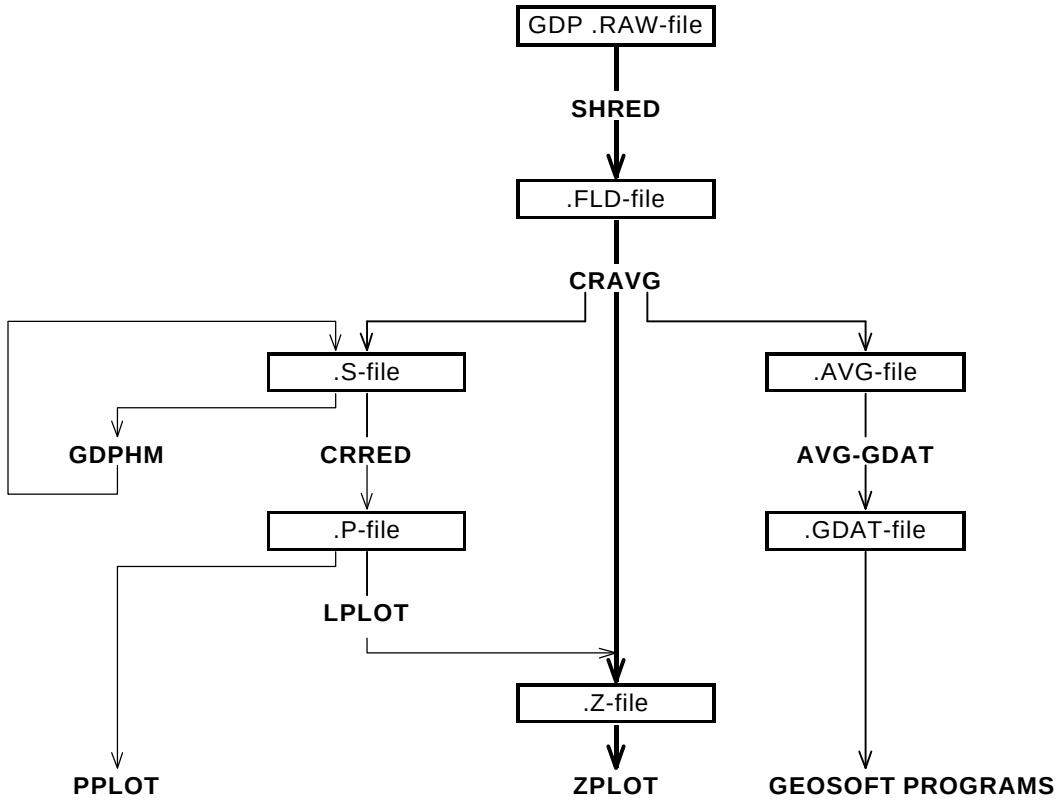
Once the ground response has been removed, the remainder is the total electro-magnetic coupling. The resistivity value, calculated by the processor in the field using the array parameters for the data station, is then used in the theoretical equation to compute the electro-magnetic coupling that would be measured for a homogeneous earth. This theoretical response is then removed from the total electro-magnetic coupling data to obtain residual electro-magnetic data. As mentioned above, electro-magnetic coupling due to array parameters is common for either a homogeneous or heterogeneous subsurface. Therefore, if homogeneous earth coupling parameters are computed for each data station and removed from the total measurement, coupling due to constant factors is eliminated. This technique is a theoretically derived method of amplifying the electro-magnetic response due to resistively inconsistent geologic units.

CR DATA PROCESSING FLOW

August, 1993

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

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



Other files read or written:

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

LPLOT Usage

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

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

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

LPLOT MODE DISPLAY

```
PROCESSING MODES USED:
+==============+=========+=========+=========+=========+=========+
|CONTROL MODES | AutoRun |DataFile |nStnsPage|         |         |
|   mode names | AUTO    | DFILE   | NSIZE   |         |         |
|  mode values |    NO   |  ZFILE  |     7   |         |         |
+==============+=========+=========+=========+=========+=========+
```

LPLOT ERROR MESSAGES

If errors or inconsistencies arise within the program, LPLOT 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.

LPLOT OUTPUT SELECTIONS

LPLOT will write listing (.L-files) or data (.Z-files). A .LOG-file is automatically created by LPLOT.

LPLOT Sample Run

Input files: SAMCR.P, SAMCR.MDE
Output files: SAMCR.LOG, SAMCR.L, SAMCR.Z

*** NOTE: responses to prompts are in **bold** type; comments regarding program operation are enclosed in stars ***

```
C: > LPLOT
ZONGE ENGINEERING: 3322 E. Fort Lowell, Tucson AZ 85716, USA
LPLOT 7.00: LINE PRINTER PLOT PROGRAM
   MS-DOS version implemented 25 August, 1992.

LPLOT VERSION UPDATE INFORMATION
1.30 Update for GDP use.
1.34 Maximize dynamic range for Rx and Tx values.
7.00 Global Modes replace .I-file.  Implement prioritized Modes.

Data filename [quit]: SAMCR                          *** Enter .S-file name ***

MODE CLIENT  =ZONGE ENGINEERING
MODE PROJECT =Sample Data
MODE JOBNUMB =000
MODE JOBDATE =SEP 91
MODE JOBLINE =10
MODE BRGLINE =N 85 E
MODE BRGBACK =S 85 W
MODE STNLO   =    -3.0
MODE STNHI   =    10.0

(Type MENU for assistance with MODEs.)

MODE Change [name?, name= value] : LIST              *** List current modes ***

PROCESSING MODE LIST:   (Type MENU for assistance)
+==============+=========+=========+=========+=========+=========+
|CONTROL MODES | AutoRun |DataFile |nStnsPage|         |         |
|   mode names | AUTO    | DFILE   | NSIZE   |         |         |
|  mode values |    NO   |  ZFILE  |     7   |         |         |
+==============+=========+=========+=========+=========+=========+

MODE Change [name?, name= value] : <CR>              *** Press RETURN       ***
  CONTOUR plotfile selected: Z-file.

Reading file "SAMCR.P" for data limits . . .
MODE ASPACE =  200.0m

Input file closed, lines read:  489

DATA FILE SUMMARY:
Stations :          14
Pnts,Frqs:          54           5
Stn limit:   -3.00000        10.0000
NSp limit:    1.00000        8.00000
Scale,nCC:    1.00000               0
Press any key to continue: <CR>                      *** Press RETURN       ***
```

LPLOT Sample Run (continued)

```
*** PLOT FILE CONTENTS:  R/P DATA & RAW DATA
=>0: New file, or EXIT                    ( => indicates default )
  1: Menu, plots of R/P data.
  3: Menu, plots of RAW DATA
YOUR choice  [0]: 1                                *** Select R/P menu    ***

=== R/P program: R/P parameters ONLY           ( => indicates default )
 ^Z: Main menu                                   10: Minimum SEM
=>0: no plot             5: Low Raw PHZ          11: Maximum SEM
  1: RESISTIVITY         6: 3-pt Low PHZ         12: Min & Max SEM
  2: CONDUCTIVITY        7: 3-pt Hi  PHZ         13: 3-pt (1.5) PHZ
  3: Raw PFE, %          8: 4-pt     PHZ         14: 3-pt (2.5) PHZ
  4:                     9:                      15:
=== PLOT of  [0]: 1                                *** Select Resistivity ***

Contour plot file  1

"Apparent RESISTIVITY                           "

CURRENT CONTOUR & DISPLAY SPECS:     (Use "MENU", "HELP", and "LIST" for aid.)
LOGARITHMIC contours (CTYP= 1), (CNUM=  5) contours per 10**(CEXP= 0) units,
(NSIG= 3) significant digits, (NDIG= 0) digits after decimal for small values.
SPEC Change [name?, name= value] : <CR>            *** Use default specs  ***

>Read file: "Apparent RESISTIVITY                          "
            "                                              "
MODE ASPACE =  200.0m

>Read done: "Apparent RESISTIVITY                          "
            "                                              "
PREVIEW  [No]? <CR>                                *** No screen preview  ***

*** PLOT FILE CONTENTS:  R/P DATA & RAW DATA
=>0: New file, or EXIT                    ( => indicates default )
  1: Menu, plots of R/P data.
  3: Menu, plots of RAW DATA
YOUR choice  [0]: <CR>                             *** No more selections ***

Log file "SAMCR.LOG" closed.

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

Appendix A ... MODE VARIABLES

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

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

MODE PROMPTS, Manual entry

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

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

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

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

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

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

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

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

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

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

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

(the program continues ...)
```

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

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

MODE CHANGE PRIORITIES

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

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

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

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

LOCAL MODE FILES

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

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

GLOBAL MODE FILES

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

DATA FILE MODE STATEMENTS

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

LPLOT MODE LIST
(v 7.0x)

PROCESSING MODE DEFAULT VALUES:

CONTROL MODES	AutoRun	DataFile	NStnsPage			
mode names	AUTO	DFILE	NSIZE			
mode values	NO	ZFILE	7			

COMPANY
Company name (40 chr max)

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

CLIENT
Client name (40 chr max)

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

PROJECT
Project name (40 chr max)

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

JOBNUMBER
Company job number (10 chr max)

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

JOBDATE
Survey date (10 chr max)

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

JOBLINE
Survey line number (10 chr max)

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

BRGLINE
Line forward bearing (10 chr max)

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

BRGBACK
Line back bearing (10 chr max)

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

STNLOW
Low station number, plot limit

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

STNHIGH
High station number, plot limit

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

STNDELT
Station number increment, plot scale

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

LBLFRST
Low station number, axis label

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

LBLDELT
Station number increment, axis label

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

FRQLO
Low frequency, plot limit

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

FRQHI
High frequency, plot limit

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

TXLEN
CSAMT Transmitter length (10 chr max)

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

TXBRG
CSAMT Transmitter bearing (10 chr max)

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

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

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

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

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

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

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

RX2TX
CSAMT Receiver to Transmitter direction

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

RXBRG
Receive dipole bearing, usually same as survey line orientation

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

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

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

PLTREV
Plot X-axis reverse selection

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

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

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

AUTO
AUTO mode will automatically delete existing output files (if any), not prompt for MODE changes (if AUTO= YES is included in the .MDE-file) and exit when completed.

If both mode AUTO and mode MENU are specified in the mode file (.MDE-file), or in the input .P-file, and the program is started by "LPLOT filename", then no prompts will be made.

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

DFILE
Choice of output file is specified by mode DFILE.

DFILE= LFILE
Printer PSEUDOSECTIONS, listing format. (.L-file)

DFILE= ZFILE
CONTOUR program PLOTFILE format. (.Z-file)

Values: DFILE= Lfile or Zfile.
Default: DFILE= Zfile

NSIZE

The number of stations per page of .L-file pseudosections is set by NSIZE. The printer may offer different print styles (fonts) which determines the number of characters that may be printed across the page. The user is responsible for selecting a value for NSIZE, and should also set the printer print style. Values from 3 to 30 stations per page are acceptable.

This table is a guide for EPSON printers. Combinations of fonts offer variations, like 272 characters per line for the EPSON 185 using a combination of "compressed" AND "elite" type.

print style (font):	draft/NLQ	Elite	Comp	Comp/Elite Compressed
stations per 8.5" page:	8	10	15	15
stations per 14." page:	15	18	27	30
characters per inch:	10	12	17	19
characters per 8.5" page:	80	96	137	165
characters per 14." page:	136	163	233	272

Values: NSIZE= Number of stations per listing page.
Default: NSIZE= 7

Appendix B ... SAMPLE FILES

Sample .LOG-file

```
LPLOT 7.00, Processed: 24 Aug 92

GLOBAL MODE LIST:
+=========================================+=============+==============+
|  COMPANY                                |  JOBNUMB    | CSAMT XMTR   |
| Zonge Engineering                       | 000         |              |
|  CLIENT                                 |  JOBDATE    |  TXLEN       |
| ZONGE ENGINEERING                       | SEP 91      |              |
|  PROJECT                                |  JOBLINE    |  TXBRG       |
| Sample Data                             | 10          |              |
+==============+==============+===========+=============+              |
|  BRGBACK     |  RXBRG       |  BRGLINE  |  FRQLO      |  TXDIS       |
| S 85 W       | N 85 E       | N 85 E    |     1/8 Hz  |              |
|  STNLO       |  STNDELT     |  STNHI    |  FRQHI      |  RX2TX       |
|     -3.0     |      1.0     |     10.0  |     1/8 Hz  |              |
|  LBLFRST     |  LBLDELT     |  PLTREV   |  UNITS      |              |
|  STNLO       |      1.0     |    NO     |  METERS     |              |
+==============+==============+===========+=============+==============+

PROCESSING MODES USED:
+==============+=========+=========+=========+=========+=========+=========+
|CONTROL MODES | AutoRun |DataFile |nStnsPage|         |         |         |
|   mode names | AUTO    | DFILE   | NSIZE   |         |         |         |
|  mode values |    NO   |  ZFILE  |     7   |         |         |         |
+==============+=========+=========+=========+=========+=========+=========+
Input file closed, lines read:  489

DATA FILE SUMMARY:
Stations :          14
Pnts,Frqs:          54           5
Stn limit:   -3.00000        10.0000
NSp limit:    1.00000        8.00000
Scale,nCC:    1.00000               0

Log file "SAMCR.LOG" closed.
```

Sample .P-file

```
/* 24 Nov 92
$ ASPACE=  200.0m
"SAMCR.P", from CRRED 7.01
 PLOT FILE FOR LPLOT      1 0
 Rx:   2.  Tx:   6.  NSp: 3.
 1 0 0  5    96.052   0.5   0.0
    3.8   4.3  -0.2   5.0   0.0
    0.1   0.2   4.5   4.8   0.0
  0.125  1.000E+00  3.800E-03
  0.375  9.969E-01  3.489E-03
  0.625  9.960E-01  4.017E-03
  0.875  9.952E-01  2.986E-03
  1.125  9.941E-01  3.479E-03
 Rx:   1.  Tx:   6.  NSp: 4.
 1 0 0  5    85.855   0.3   0.0
    2.0   2.7  -4.9   3.9   0.0
    0.2   0.3   3.0   3.6   0.0
  0.125  1.000E+00  2.000E-03
  0.375  9.979E-01  1.763E-03
  0.625  9.978E-01  3.027E-03
  0.875  9.978E-01  1.730E-03
  1.125  9.968E-01  2.824E-03
 Rx:   0.  Tx:   6.  NSp: 5.
 1 0 0  5    87.857   0.1   0.0
    1.7   3.2 -11.1   5.6   0.0
    0.4   0.6   4.0   5.5   0.0
  0.125  1.000E+00  1.667E-03
  0.375  9.981E-01  1.198E-03
  0.625  9.995E-01  4.231E-03
  0.875  9.994E-01  3.131E-03
  1.125  9.982E-01  6.455E-03
 Rx:  -1.  Tx:   6.  NSp: 6.
 1 0 0  5   171.925   0.4   0.0
    2.7   3.8 -17.1   7.2   0.0
    0.6   1.0   4.7   6.3   0.0
  0.125  1.000E+00  2.667E-03
  0.375  9.966E-01  3.388E-03
  0.625  9.973E-01  8.012E-03
  0.875  9.981E-01  5.456E-03
  1.125  9.947E-01  1.088E-02
 Rx:  -2.  Tx:   6.  NSp: 7.
 1 0 0  5   270.02    0.6   0.0
    5.3   8.5 -29.9  14.9   0.0
    1.1   1.2  10.5  13.8   0.0
  0.125  1.000E+00  5.267E-03
  0.375  9.942E-01  4.839E-03
  0.625  9.949E-01  1.260E-02
  0.875  9.957E-01  8.132E-03
  1.125  9.916E-01  1.656E-02
 Rx:  -3.  Tx:   6.  NSp: 8.
 1 0 0  5   430.134   0.8   0.0
    6.1   9.2 -33.0  16.2   0.0
    1.1   1.6  11.3  14.9   0.0
  0.125  1.000E+00  6.067E-03
  0.375  9.929E-01  6.388E-03
  0.625  9.939E-01  1.547E-02
  0.875  9.943E-01  1.094E-02
  1.125  9.893E-01  2.246E-02
 Rx:   2.  Tx:   5.  NSp: 2.
 1 0 0  5   105.053   0.5   0.0
    3.1   3.0   2.5   3.1   0.0
    0.0   0.0   3.0   2.9   0.0
  0.125  1.000E+00  3.100E-03
  0.375  9.978E-01  3.193E-03
  0.625  9.963E-01  3.138E-03
  0.875  9.955E-01  2.688E-03
  1.125  9.952E-01  2.488E-03
```

continued next column ...

```
 Rx:   1.  Tx:   5.  NSp: 3.
 1 0 0  5    69.31    0.6   0.0
    4.1   4.6   1.0   5.2   0.0
    0.1   0.1   4.7   4.9   0.0
  0.125  1.000E+00  4.150E-03
  0.375  9.974E-01  3.640E-03
  0.625  9.954E-01  3.683E-03
  0.875  9.939E-01  2.385E-03
  1.125  9.947E-01  3.531E-03
 Rx:   0.  Tx:   5.  NSp: 4.
 1 0 0  5    64.962   0.5   0.0
    3.3   4.3  -4.3   5.8   0.0
    0.2   1.0   4.8   5.5   0.0
  0.125  1.000E+00  3.350E-03
  0.375  9.968E-01  2.791E-03
  0.625  9.947E-01  4.128E-03
  0.875  9.932E-01  2.781E-03
  1.125  9.964E-01  3.338E-03
 Rx:  -1.  Tx:   5.  NSp: 5.
 1 0 0  5   121.75    0.9   0.0
    6.1   6.2  -1.6   7.5   0.0
    0.4   1.0   6.3   6.6   0.0
  0.125  1.000E+00  6.050E-03
  0.375  9.979E-01  6.187E-03
  0.625  9.939E-01  6.908E-03
  0.875  9.888E-01  4.104E-03
  1.125  9.924E-01  8.932E-03
 Rx:  -2.  Tx:   5.  NSp: 6.
 1 0 0  5   186.783   1.2   0.0
    7.8   9.2  -8.3  12.1   0.0
    0.6   0.8   9.8  10.9   0.0
  0.125  1.000E+00  7.800E-03
  0.375  9.963E-01  7.124E-03
  0.625  9.900E-01  9.157E-03
  0.875  9.843E-01  4.725E-03
  1.125  9.913E-01  1.081E-02
 Rx:  -3.  Tx:   5.  NSp: 7.
 1 0 0  5   294.275   1.6   0.0
    8.8  10.4 -13.2  14.3   0.0
    0.8   1.0  11.2  12.6   0.0
  0.125  1.000E+00  8.850E-03
  0.375  9.962E-01  8.369E-03
  0.625  9.878E-01  1.131E-02
  0.875  9.804E-01  5.294E-03
  1.125  9.888E-01  1.315E-02
 Rx:   2.  Tx:   4.  NSp: 1.
 1 0 0  5   133.897   0.3   0.0
    1.7   1.4   2.1   1.3   0.0
    0.0   0.0   1.4   1.2   0.0
  0.125  1.000E+00  1.700E-03
  0.375  9.985E-01  1.947E-03
  0.625  9.978E-01  1.846E-03
  0.875  9.973E-01  1.745E-03
  1.125  9.967E-01  1.395E-03
 Rx:   1.  Tx:   4.  NSp: 2.
 1 0 0  5    89.295   0.6   0.0
    4.2   4.3   4.8   4.2   0.0
    0.0   0.0   4.3   4.2   0.0
  0.125  1.000E+00  4.200E-03
  0.375  9.969E-01  3.988E-03
  0.625  9.956E-01  3.733E-03
  0.875  9.946E-01  3.680E-03
  1.125  9.936E-01  3.428E-03
```

continued next column .../

```
 Rx:   0.  Tx:   4.  NSp: 3.
 1 0 0  5    84.754   0.7   0.0
    5.1   5.6   3.7   5.9   0.0
    0.1   0.2   5.8   6.0   0.0
  0.125  1.000E+00  5.100E-03
  0.375  9.965E-01  4.634E-03
  0.625  9.951E-01  4.876E-03
  0.875  9.939E-01  4.821E-03
  1.125  9.931E-01  6.108E-03
 Rx:  -1.  Tx:   4.  NSp: 4.
 1 0 0  5   164.601   0.9   0.0
    7.0   6.9   8.8   6.6   0.0
    0.1   0.1   6.8   6.7   0.0
  0.125  1.000E+00  7.050E-03
  0.375  9.949E-01  7.114E-03
  0.625  9.928E-01  6.900E-03
  0.875  9.918E-01  7.389E-03
  1.125  9.895E-01  7.818E-03
 Rx:  -2.  Tx:   4.  NSp: 5.
 1 0 0  5   256.177   1.3   0.0
    9.6   9.3  11.9   8.9   0.0
    0.2   0.3   9.3   9.1   0.0
  0.125  1.000E+00  9.550E-03
  0.375  9.929E-01  9.582E-03
  0.625  9.903E-01  9.259E-03
  0.875  9.887E-01  9.887E-03
  1.125  9.850E-01  1.079E-02
 Rx:  -3.  Tx:   4.  NSp: 6.
 1 0 0  5   412.136   1.5   0.0
   10.9  10.8  14.2  10.2   0.0
    0.2   0.3  10.7  10.5   0.0
  0.125  1.000E+00  1.090E-02
  0.375  9.922E-01  1.082E-02
  0.625  9.891E-01  1.044E-02
  0.875  9.873E-01  1.155E-02
  1.125  9.825E-01  1.282E-02
 Rx:   1.  Tx:   3.  NSp: 1.
 1 0 0  5    88.347   0.3   0.0
    2.0   1.9   1.8   1.9   0.0
    0.0   0.0   1.9   1.8   0.0
  0.125  1.000E+00  2.050E-03
  0.375  9.984E-01  2.146E-03
  0.625  9.975E-01  2.045E-03
  0.875  9.970E-01  1.695E-03
  1.125  9.965E-01  1.644E-03
 Rx:   0.  Tx:   3.  NSp: 2.
 1 0 0  5    89.501   0.4   0.0
    3.9   4.1   7.3   3.5   0.0
    0.1   0.1   4.1   4.3   0.0
  0.125  1.000E+00  3.950E-03
  0.375  9.974E-01  3.940E-03
  0.625  9.962E-01  4.234E-03
  0.875  9.973E-01  6.533E-03
  1.125  9.944E-01  7.011E-03
 Rx:  -1.  Tx:   3.  NSp: 3.
 1 0 0  5   193.83    0.8   0.0
    5.6   5.8   4.5   6.0   0.0
    0.2   0.2   5.9   6.2   0.0
  0.125  1.000E+00  5.600E-03
  0.375  9.959E-01  5.677E-03
  0.625  9.941E-01  6.362E-03
  0.875  9.935E-01  6.954E-03
  1.125  9.913E-01  7.633E-03
```

continued next page ...

Sample .P-file (page 2)

```
 Rx:  -2.  Tx:   3.  NSp: 4.
 1 0 0  5   323.229   1.1   0.0
    8.0   8.6   5.6   9.1   0.0
    0.3   0.6   8.9   9.4   0.0
  0.125  1.000E+00  8.000E-03
  0.375  9.943E-01  7.607E-03
  0.625  9.918E-01  8.480E-03
  0.875  9.907E-01  9.015E-03
  1.125  9.869E-01  9.178E-03
 Rx:  -3.  Tx:   3.  NSp: 5.
 1 0 0  5   553.527   1.5   0.0
   10.3  10.7  10.4  10.8   0.0
    0.4   0.9  10.9  11.2   0.0
  0.125  1.000E+00  1.035E-02
  0.375  9.920E-01  1.007E-02
  0.625  9.887E-01  1.058E-02
  0.875  9.878E-01  1.166E-02
  1.125  9.834E-01  1.387E-02
 Rx:   0.  Tx:   2.  NSp: 1.
 1 0 0  5   130.331   0.3   0.0
    0.4   0.3   1.1   0.1   0.0
    0.1   0.1   0.2   0.0   0.0
  0.125  1.000E+00  4.500E-04
  0.375  9.992E-01  3.997E-04
  0.625  9.976E-01 -1.496E-04
  0.875  9.983E-01 -7.487E-04
  1.125  9.966E-01 -1.744E-03
 Rx:  -1.  Tx:   2.  NSp: 2.
 1 0 0  5   336.156   0.5   0.0
    2.8   2.5   1.8   2.7   0.0
    0.0   0.0   2.5   2.5   0.0
  0.125  1.000E+00  2.850E-03
  0.375  9.979E-01  3.343E-03
  0.625  9.967E-01  3.688E-03
  0.875  9.955E-01  3.484E-03
  1.125  9.954E-01  3.583E-03
 Rx:  -2.  Tx:   2.  NSp: 3.
 1 0 0  5   602.329   0.9   0.0
    6.3   5.6   4.9   5.8   0.0
    0.1   0.1   5.6   5.5   0.0
  0.125  1.000E+00  6.250E-03
  0.375  9.955E-01  7.167E-03
  0.625  9.934E-01  7.748E-03
  0.875  9.910E-01  7.582E-03
  1.125  9.905E-01  8.073E-03
 Rx:  -3.  Tx:   2.  NSp: 4.
 1 0 0  5  1125.703   1.2   0.0
    7.9   7.4   3.7   8.0   0.0
    0.1   0.2   7.4   7.6   0.0
  0.125  1.000E+00  7.850E-03
  0.375  9.945E-01  8.901E-03
  0.625  9.918E-01  1.017E-02
  0.875  9.885E-01  9.688E-03
  1.125  9.879E-01  1.087E-02
 Rx:  -1.  Tx:   1.  NSp: 1.
 1 0 0  5   134.45    0.2   0.0
    1.1   0.8   1.3   0.7   0.0
    0.0   0.0   0.7   0.6   0.0
  0.125  1.000E+00  1.100E-03
  0.375  9.991E-01  1.549E-03
  0.625  9.985E-01  1.698E-03
  0.875  9.982E-01  1.847E-03
  1.125  9.978E-01  1.796E-03
 Rx:  -2.  Tx:   1.  NSp: 2.
 1 0 0  5   284.702   0.7   0.0
    4.5   4.0   3.8   4.0   0.0
    0.0   0.0   3.9   3.8   0.0
  0.125  1.000E+00  4.550E-03
  0.375  9.965E-01  5.431E-03
  0.625  9.948E-01  5.969E-03
  0.875  9.936E-01  6.061E-03
  1.125  9.926E-01  6.154E-03
```

continued next column ...

```
 Rx:  -3.  Tx:   1.  NSp: 3.
 1 0 0  5   618.171   0.9   0.0
    6.5   5.9   5.9   5.9   0.0
    0.0   0.0   5.8   5.8   0.0
  0.125  1.000E+00  6.500E-03
  0.375  9.953E-01  7.565E-03
  0.625  9.928E-01  8.389E-03
  0.875  9.912E-01  8.971E-03
  1.125  9.901E-01  9.208E-03
 Rx:   5.  Tx:   1.  NSp: 3.
 1 0 0  5    66.619   0.7   0.0
    5.8   7.8   6.8   7.9   0.0
    0.5   0.8   8.2   8.9   0.0
  0.125  1.000E+00  5.800E-03
  0.375  9.969E-01  3.390E-03
  0.625  9.949E-01  3.018E-03
  0.875  9.936E-01  4.173E-03
  1.125  9.928E-01  3.740E-03
 Rx:   6.  Tx:   1.  NSp: 4.
 1 0 0  5    82.479   0.3   0.0
    2.2   2.3  -0.7   2.7   0.0
    0.2   0.2   2.4   2.6   0.0
  0.125  1.000E+00  2.233E-03
  0.375  9.985E-01  2.530E-03
  0.625  9.976E-01  3.292E-03
  0.875  9.983E-01  2.962E-03
  1.125  9.966E-01  3.754E-03
 Rx:   7.  Tx:   1.  NSp: 5.
 1 0 0  5   114.302   0.4   0.0
    3.0   2.4  -0.6   2.9   0.0
    0.3   0.4   2.5   2.6   0.0
  0.125  1.000E+00  2.967E-03
  0.375  9.975E-01  4.090E-03
  0.625  9.968E-01  5.316E-03
  0.875  9.985E-01  5.026E-03
  1.125  9.941E-01  7.688E-03
 Rx:   8.  Tx:   1.  NSp: 6.
 1 0 0  5   149.739   0.5   0.0
    4.1   3.5  -2.0   4.4   0.0
    0.5   0.6   3.6   3.9   0.0
  0.125  1.000E+00  4.100E-03
  0.375  9.968E-01  5.615E-03
  0.625  9.957E-01  7.634E-03
  0.875  9.974E-01  7.248E-03
  1.125  9.929E-01  1.013E-02
 Rx:   9.  Tx:   1.  NSp: 7.
 1 0 0  5   166.572   0.6   0.0
    5.1   4.5  -5.3   6.2   0.0
    0.6   0.7   4.8   5.4   0.0
  0.125  1.000E+00  5.067E-03
  0.375  9.959E-01  6.971E-03
  0.625  9.941E-01  1.004E-02
  0.875  9.969E-01  9.072E-03
  1.125  9.909E-01  1.292E-02
 Rx:   5.  Tx:   2.  NSp: 2.
 1 0 0  5   113.827   0.5   0.0
    3.1   1.8  13.3  -0.1   0.0
    0.6   0.7   1.2   0.3   0.0
  0.125  1.000E+00  3.100E-03
  0.375  9.964E-01  3.737E-03
  0.625  9.969E-01  1.894E-03
  0.875  9.956E-01  3.634E-03
  1.125  9.942E-01  3.778E-03
 Rx:   6.  Tx:   2.  NSp: 3.
 1 0 0  5   102.88    0.7   0.0
    3.6   3.2   5.6   2.8   0.0
    0.3   0.3   3.1   2.8   0.0
  0.125  1.000E+00  3.650E-03
  0.375  9.970E-01  4.038E-03
  0.625  9.954E-01  3.782E-03
  0.875  9.942E-01  4.176E-03
  1.125  9.921E-01  5.704E-03
```

continued next column ...

```
 Rx:   7.  Tx:   2.  NSp: 4.
 1 0 0  5   137.629   1.1   0.0
    4.9   5.2   3.3   5.5   0.0
    0.5   0.8   5.4   5.8   0.0
  0.125  1.000E+00  4.950E-03
  0.375  9.958E-01  5.128E-03
  0.625  9.928E-01  6.255E-03
  0.875  9.917E-01  7.338E-03
  1.125  9.875E-01  1.121E-02
 Rx:   8.  Tx:   2.  NSp: 5.
 1 0 0  5   180.672   1.4   0.0
    6.1   4.9  10.6   4.0   0.0
    0.8   1.1   4.7   4.3   0.0
  0.125  1.000E+00  6.050E-03
  0.375  9.945E-01  7.509E-03
  0.625  9.914E-01  7.931E-03
  0.875  9.895E-01  1.034E-02
  1.125  9.822E-01  1.636E-02
 Rx:   9.  Tx:   2.  NSp: 6.
 1 0 0  5   201.98    1.8   0.0
    6.8   5.0  14.9   3.4   0.0
    1.0   1.7   4.6   4.0   0.0
  0.125  1.000E+00  6.800E-03
  0.375  9.932E-01  8.989E-03
  0.625  9.896E-01  9.451E-03
  0.875  9.870E-01  1.338E-02
  1.125  9.767E-01  2.242E-02
 Rx:   5.  Tx:   3.  NSp: 1.
 1 0 0  5   118.451   0.2   0.0
    1.1   1.0   1.3   1.0   0.0
    0.0   0.0   1.0   0.8   0.0
  0.125  1.000E+00  1.133E-03
  0.375  9.989E-01  1.165E-03
  0.625  9.983E-01  9.317E-04
  0.875  9.980E-01  5.988E-04
  1.125  9.974E-01  6.649E-05
 Rx:   6.  Tx:   3.  NSp: 2.
 1 0 0  5    77.889   0.5   0.0
    3.2   3.3   3.1   3.3   0.0
    0.1   0.1   3.3   3.2   0.0
  0.125  1.000E+00  3.200E-03
  0.375  9.976E-01  3.026E-03
  0.625  9.965E-01  2.823E-03
  0.875  9.955E-01  2.489E-03
  1.125  9.945E-01  1.624E-03
 Rx:   7.  Tx:   3.  NSp: 3.
 1 0 0  5    90.974   0.9   0.0
    5.5   5.0   5.6   4.9   0.0
    0.2   0.3   4.9   4.7   0.0
  0.125  1.000E+00  5.500E-03
  0.375  9.956E-01  6.040E-03
  0.625  9.929E-01  6.023E-03
  0.875  9.920E-01  5.754E-03
  1.125  9.910E-01  4.228E-03
 Rx:   8.  Tx:   3.  NSp: 4.
 1 0 0  5   116.43    1.2   0.0
    6.9   6.4   7.2   6.2   0.0
    0.4   0.5   6.2   6.1   0.0
  0.125  1.000E+00  6.900E-03
  0.375  9.945E-01  7.525E-03
  0.625  9.917E-01  7.636E-03
  0.875  9.902E-01  7.658E-03
  1.125  9.861E-01  3.846E-03
 Rx:   9.  Tx:   3.  NSp: 5.
 1 0 0  5   126.677   1.4   0.0
    7.8   7.3   7.7   7.3   0.0
    0.7   0.8   7.3   7.2   0.0
  0.125  1.000E+00  7.800E-03
  0.375  9.938E-01  8.547E-03
  0.625  9.906E-01  9.114E-03
  0.875  9.887E-01  9.689E-03
  1.125  9.829E-01  3.243E-03
```

continued next page ...

Sample .P-file (page 3)

```
 Rx:   6.  Tx:   4.  NSp: 1.
 1 0 0  5   105.289   0.3   0.0
    0.5   1.5   1.4   1.6   0.0
    0.0   0.0   1.5   1.3   0.0
  0.125  1.000E+00  5.500E-04
  0.375  9.986E-01 -1.598E-03
  0.625  9.977E-01 -3.941E-03
  0.875  9.973E-01 -6.582E-03
  1.125  9.969E-01 -8.923E-03
 Rx:   7.  Tx:   4.  NSp: 2.
 1 0 0  5   118.16    0.5   0.0
    3.9   3.1   5.1   2.8   0.0
    0.1   0.3   2.9   2.6   0.0
  0.125  1.000E+00  3.950E-03
  0.375  9.969E-01  4.885E-03
  0.625  9.955E-01  4.878E-03
  0.875  9.955E-01  4.978E-03
  1.125  9.943E-01  4.872E-03
 Rx:   8.  Tx:   4.  NSp: 3.
 1 0 0  5   154.637   0.9   0.0
    6.3   5.5   4.6   5.7   0.0
    0.1   0.2   5.4   5.3   0.0
  0.125  1.000E+00  6.300E-03
  0.375  9.952E-01  7.464E-03
  0.625  9.925E-01  8.139E-03
  0.875  9.920E-01  7.837E-03
  1.125  9.905E-01  8.767E-03
 Rx:   9.  Tx:   4.  NSp: 4.
 1 0 0  5   176.787   1.0   0.0
    7.5   6.3   4.2   6.7   0.0
    0.2   0.3   6.2   6.0   0.0
  0.125  1.000E+00  7.550E-03
  0.375  9.941E-01  9.344E-03
  0.625  9.907E-01  1.040E-02
  0.875  9.910E-01  9.613E-03
  1.125  9.890E-01  1.142E-02
 Rx:   7.  Tx:   5.  NSp: 1.
 1 0 0  5   122.581   0.6   0.0
    3.2   3.9   1.5   4.2   0.0
    0.0   0.3   4.1   4.6   0.0
  0.125  1.000E+00  3.200E-03
  0.375  9.972E-01  2.726E-03
  0.625  9.961E-01  3.387E-03
  0.875  9.950E-01  3.947E-03
  1.125  9.939E-01  3.943E-03
```

continued next column ...

```
 Rx:   8.  Tx:   5.  NSp: 2.
 1 0 0  5   174.9     0.9   0.0
    5.5   4.8   5.9   4.6   0.0
    0.1   0.1   4.7   4.5   0.0
  0.125  1.000E+00  5.500E-03
  0.375  9.957E-01  6.472E-03
  0.625  9.934E-01  6.888E-03
  0.875  9.918E-01  7.339E-03
  1.125  9.909E-01  7.333E-03
 Rx:   9.  Tx:   5.  NSp: 3.
 1 0 0  5   219.989   1.1   0.0
    6.9   5.9   7.4   5.6   0.0
    0.1   0.2   5.7   5.5   0.0
  0.125  1.000E+00  6.867E-03
  0.375  9.946E-01  8.289E-03
  0.625  9.916E-01  8.990E-03
  0.875  9.900E-01  9.768E-03
  1.125  9.891E-01  1.055E-02
 Rx:   8.  Tx:   6.  NSp: 1.
 1 0 0  5   254.35    0.9   0.0
    5.6   5.1   5.3   5.1   0.0
    0.0   0.0   5.0   4.8   0.0
  0.125  1.000E+00  5.550E-03
  0.375  9.955E-01  6.023E-03
  0.625  9.929E-01  5.958E-03
  0.875  9.913E-01  5.452E-03
  1.125  9.900E-01  4.752E-03
 Rx:   9.  Tx:   6.  NSp: 2.
 1 0 0  5   349.726   1.2   0.0
    7.6   6.5   7.1   6.5   0.0
    0.0   0.0   6.4   6.1   0.0
  0.125  1.000E+00  7.600E-03
  0.375  9.942E-01  9.047E-03
  0.625  9.909E-01  9.712E-03
  0.875  9.888E-01  9.888E-03
  1.125  9.870E-01  1.002E-02
```

*** end of file ***

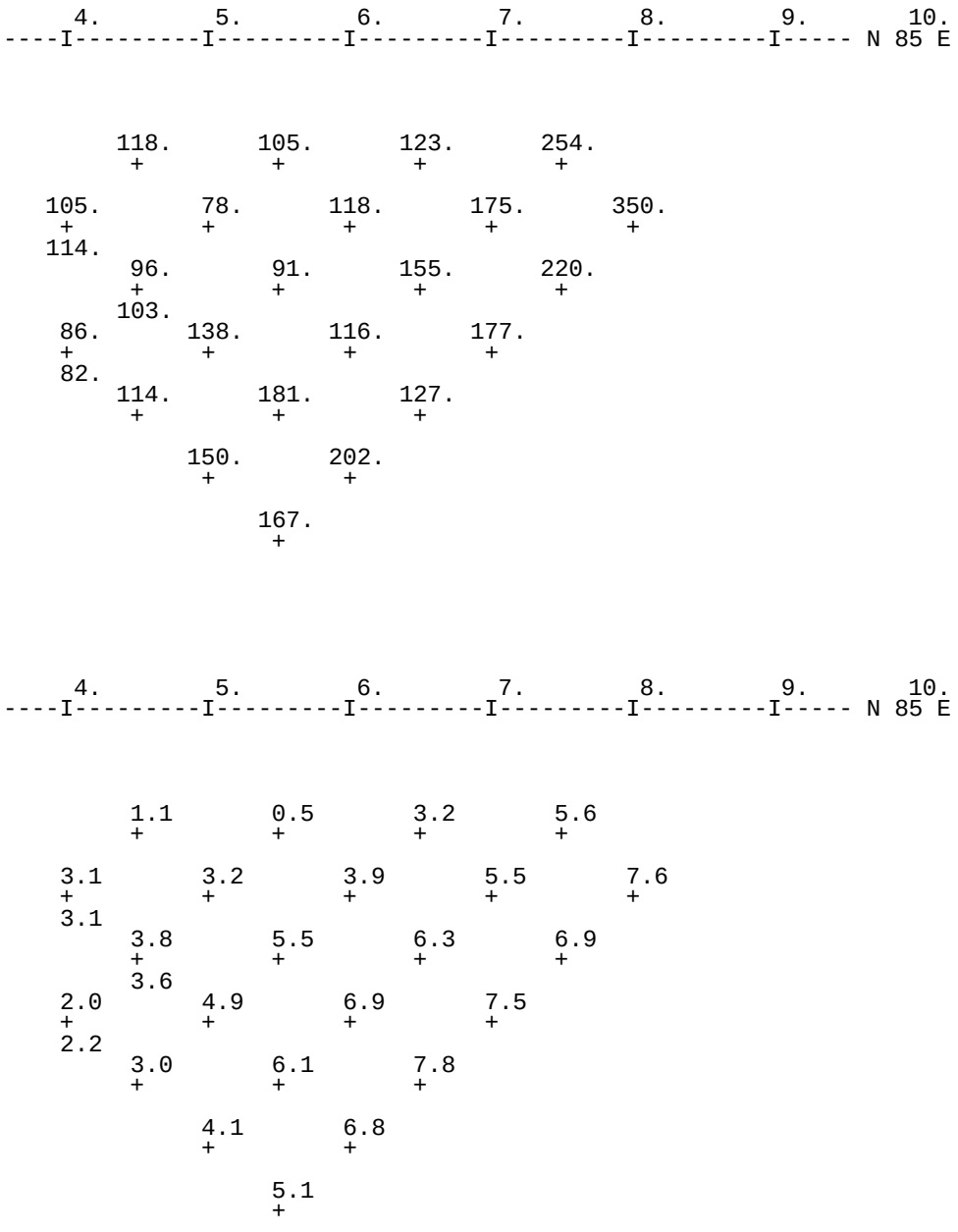
Sample .Z-file

```
/* 24 Aug 92
$ ASPACE= 200.0m
$ ZPLOT: DATA= N-SP
 LPLOT 7.00 Contour file.
 Cl Cn Ce Ns Nd Yl   Plot file  1
  1  5  0  3  0  0
 R/P SURVEY DATA
 Apparent RESISTIVITY
  (ohm-meters)
IIxxxxxxxxYYYYYYYYzzzzzzzzzzz  AAA
 2    4.5     3.     9.605E+01
 2    4.      4.     8.586E+01
 2    3.5     5.     8.786E+01
 2    3.      6.     1.719E+02
 2    2.5     7.     2.700E+02
 2    2.      8.     4.301E+02
 2    4.      2.     1.051E+02
 2    3.5     3.     6.931E+01
 2    3.      4.     6.496E+01
 2    2.5     5.     1.218E+02
 2    2.      6.     1.868E+02
 2    1.5     7.     2.943E+02
 2    3.5     1.     1.339E+02
 2    3.      2.     8.929E+01
 2    2.5     3.     8.475E+01
 2    2.      4.     1.646E+02
 2    1.5     5.     2.562E+02
 2    1.      6.     4.121E+02
 2    2.5     1.     8.835E+01
 2    2.      2.     8.950E+01
 2    1.5     3.     1.938E+02
 2    1.      4.     3.232E+02
 2    0.5     5.     5.535E+02
 2    1.5     1.     1.303E+02
 2    1.      2.     3.362E+02
 2    0.5     3.     6.023E+02
 2    0.      4.     1.126E+03
 2    0.5     1.     1.344E+02
 2    0.      2.     2.847E+02
 2   -0.5     3.     6.182E+02
 2    3.5     3.     6.662E+01
 2    4.      4.     8.248E+01
 2    4.5     5.     1.143E+02
 2    5.      6.     1.497E+02
 2    5.5     7.     1.666E+02
 2    4.      2.     1.138E+02
 2    4.5     3.     1.029E+02
 2    5.      4.     1.376E+02
 2    5.5     5.     1.807E+02
 2    6.      6.     2.020E+02
 2    4.5     1.     1.185E+02
 2    5.      2.     7.789E+01
 2    5.5     3.     9.097E+01
 2    6.      4.     1.164E+02
 2    6.5     5.     1.267E+02
 2    5.5     1.     1.053E+02
 2    6.      2.     1.182E+02
 2    6.5     3.     1.546E+02
 2    7.      4.     1.768E+02
 2    6.5     1.     1.226E+02
 2    7.      2.     1.749E+02
 2    7.5     3.     2.200E+02
 2    7.5     1.     2.544E+02
 2    8.      2.     3.497E+02
 9999.0
```

Sample .L-file

```
Zonge Engineering                                                  LPLOT 7.00
R/P SURVEY DATA      ZONGE ENGINEERING

Sample Data                                LINE: 10
           JOB: 000                     ORIENT.: N 85 E
          DATE: SEP 91                    A-SP:  200.0m

Apparent RESISTIVITY
  and  Raw PHASE, 0.125  Hz


  Apparent RESISTIVITY     (ohm-meters)

    -3.       -2.       -1.        0.        1.        2.        3.
   S 85 W ----I---------I---------I---------I---------I---------I---------



                                      134.      130.       88.      134.
                                       +         +         +         +

                                 285.      336.       90.       89.
                                  +         +         +         +

                            618.      602.      194.       85.       69.
                             +         +         +         +         +
                                                                     67.
                                 1126      323.      165.       65.
                                  +         +         +         +

                                      554.      256.      122.       88.
                                       +         +         +         +

                                           412.      187.      172.
                                            +         +         +

                                                294.      270.
                                                 +         +

                                                     430.
                                                      +

  Raw PHASE, 0.125  Hz     (milliradians)

    -3.       -2.       -1.        0.        1.        2.        3.
   S 85 W ----I---------I---------I---------I---------I---------I---------



                                       1.1       0.4       2.0       1.7
                                       +         +         +         +

                                  4.5       2.8       3.9       4.2
                                  +         +         +         +

                             6.5       6.3       5.6       5.1       4.1
                             +         +         +         +         +
                                                                     5.8
                                  7.9       8.0       7.0       3.3
                                  +         +         +         +

                                      10.3       9.6       6.1       1.7
                                       +         +         +         +

                                           10.9       7.8       2.7
                                            +         +         +

                                                 8.8       5.3
                                                 +         +

                                                      6.1
                                                      +
```

Sample .L-file (page 2)



Appendix C ... FILE DOCUMENTATION

.P-file Format (v2.0) CR / RPIP Processed Data File

CRRED will create a .P-file as shown below with decoupling parameters if the .S-file has been decoupled. Otherwise, lines 8, 9, 10, and 11 will not be included in the .P-file.

.P-file EXPLANATIONS

The .P-file is composed of blocks of data, each containing data for one pseudosection data point. Each block is composed of a line to indicate the specific point, several lines of parameters, followed by an array of data that includes frequency, real and imaginary components for a number of points that describe a curve.

Two flags appear on lines 3 and 5 - MSF and MZF ("9 1" in this file). They define the type of data in the array. They are duplicated in each block (as line 5).

The MSF flag describes the type of curve shown in the .P-file. Four columns appear in the description below. The first column shows the number that appears in the .P-file. The second column describes the option. The third column indicates whether this option is available with manual decoupling. The fourth column indicates whether this option is available with AUTO decoupling.

MSF	CURVE TYPE	MANUAL DECOUPLING	AUTO DECOUPLING
0	RP parameters only (no curve data)	YES	YES
1	Raw data (decalibrated)	YES	NO
2	IP response	YES	NO
3	Hilbert IP response	YES	NO
4	Undefined	N/A	N/A
5	Raw partial EM	YES	NO
6	Normalized partial EM	YES	NO
7	Total EM	YES	NO
8	Raw Residual EM	YES	NO
9	Normalized Residual EM	YES	YES
10	Experimental REM	NO	YES

NOTE: Undecoupled data points do not appear in this file.

The MZF flag describes the DC phase used during decoupling.

1: determined by manual decoupling program
2: 3PT LOW
3: 3PT HIGH
4: 4PT
5: Constant, specified by operator

Numbers 2-5 are used by the AUTO decoupling program.

.P-file Format (v2.0) (Continued)

SAMPLE .P-FILE

```
LINE 1:  $ ASPACE= 200.0
     2:   "Sample.P", from CRRED 7.00
     3:   PLOT FILE FOR LPLOT      9 1
     4:   Rx:  2.0  Tx:  4.0  NSP: 1.0
     5:   9 1 4 18      82.7   0.9   0.5
     6:      5.7   2.5   0.0   0.0   2.3
     7:      0.0   0.0   0.0   5.0   3.1
     8:      1.422   0.069  171.
     9:      0.075   0.228  15.7
    10:      0.043   0.413  4.80
    11:     -0.003   1.478 0.375
    12:      2.955  -0.306   0.719
    13:     -0.349  -0.287  -0.098   C C b
    14:     -0.338  -0.228  -0.080
    15:    0.125  6.538E+01 -1.868E+02
           0.375  5.208E+01 -1.553E+02
           0.625  3.188E+01 -1.348E+02
```

DOCUMENTATION OF DATA FILE BY LINE NUMBER:

LINE:	EXPLANATION:
`1: $ ASPACE= 200.0`	:MODE line, defining A-Spacing in meters.
`2: "Sample.P", from CRRED 7.00`	:Original name of .P-file and data processing program name and version number
`3: PLOT FILE FOR LPLOT`	:Header
`9`	:MSF flag (Normalized Residual EM curve)
`1`	:MZF flag (manual decoupling)
`4: Rx: 2.0`	:Receiver location designator
`Tx: 4.0`	:Transmitter location designator

Dipoles extend between two adjacent stations, with the lowest numbered station entered for each dipole.

The 2 in this file indicates that the receiver dipole was positioned between stations 2 and 3. The 4 in this file indicates that the transmitter dipole was positioned between stations 4 and 5.

-3 would indicate that the dipole was positioned between stations -3 and -2.

.P-file Format (v2.0) (Cont'd)

```
   NSP: 1.0      :N-spacing (number of a-spacings between receiver and transmit dipoles)


5:      9        :MSF flag

        1        :MZF flag

        4        :Number of lines of coupling coefficients.

       18        :Number of lines of harmonics.

     82.7        :Apparent resistivity, in ohm-meters.
```

Dipole-dipole resistivity calculation:

$$\left(\frac{MG1}{4/\pi} * \frac{C}{FPGAIN}\right) * \frac{ASPACING}{CRT} * \pi * NSP * (NSP + 1) * (NSP + 2)$$

where MG1 = raw Fourier magnitude, in volts
4/π corrects MG1 from the magnitude measured at the Fourier harmonic to the actual square-wave magnitude
** C = communications-wire attenuation factor (see below) This corrects for the voltage drop which occurs along the wire between the field preamp and the GDP
** FPGAIN = field pre-amp gain
ASPACING = the a-spacing used, in meters
CRT = current, in amps
NSP = n-spacing

The first two terms in the expression correct for the Fourier magnitude, comm-wire resistance, and field preamplification. The product of these terms is the actual square-wave voltage of the received waveform.

The rest of the equation corrects for the transmitted current and the electrode geometry. For arrays other than dipole-dipole, the apparent resistivity must be calculated by hand.

** Comm-wire attenuation factors at 0.125 Hz (W21C wire)

Number of reels=		
0	1.0000	= Attenuation factor
1	0.9519	
2	0.9070	
3	0.8664	
4	0.8285	
5	0.7946	
6	0.7624	
7	0.7334	
8	0.7062	

NOTE: RHO has been corrected to DC for decoupled data.

** applies to referenced CR data.

.P-file Format (v2.0) (Continued)

`0.9` :Raw percent frequency effect (PFE).

Percent Frequency Effect Calculation

`PFE= 100 * (Mag1-Mag8) / Mag8`

`where Mag1` = 1st harmonic magnitude

`Mag8` = average magnitude of 7th + 9th harmonics, in volts.

`Mag8 = (Mag7 + Mag9)/2`

`where Mag7` = 7th harmonic magnitude
`Mag9` = 9th harmonic magnitude

`0.5` :IP PFE.

`6:` `5.7` :Raw low frequency phase,

`2.5` :3pt low DC phase,

`0.0` :3pt high DC phase,

`0.0` :4pt DC phase.

The latter two values are determined for AUTO decoupling, not for manual.

`2.3` :Calculated 3-point DC phase (ϕ_{3pt}):

$\phi_{3pt} = (15/8) * \phi_1 - (10/8) * \phi_3 + (3/8) * \phi_5$

where ϕ_1 = harmonic phase at fundamental frequency

ϕ_3 = harmonic phase at third harmonic

ϕ_5 = harmonic phase at fifth harmonic

`7:` `0.0` :Minimum SEM

`0.0` :Maximum SEM

`0.0` :undefined

`5.0` :1.00 Hz IP phase, in milliradians

`3.1` :0.125 Hz IP phase, in milliradians

.P-file Format (v2.0) (Continued)

`8,9,10,11` : Coupling coefficients, levels 1, 2, 3, 4 respectively. The number of levels varies according to the third value on line 5, as determined during manual decoupling. If the number on line 5 is zero, the station has not been decoupled.

`12:  2.955` :Hilbert response parameters: phase

`-0.306` : slope 1

`0.719` : slope 2

`13: -0.349` :Spectral type values (.125-1.000 Hz)

`-0.287` : (1.0-8.0 Hz)

`-0.080` : (8.0-88.0 Hz)

`C C b` : Spectral type characters for these frequency blocks. These values represent the slopes of curve segments in the frequency vs. imaginary plane for the decoupled IP response.

Curve types are defined as follows:

type	slope
A	≥ 20%
a	10 to 20%
B	0 to 20%
b	-10 to 0%
c	-20 to -10%
C	≤ -20%

`14: -0.338` :Derivatives (.125-1.0 Hz)

`-0.228` (1.0-8.0 Hz)

`-0.080` (8.0-88.0 Hz)

These values represent the slopes of curve segments in the real vs imaginary plane for the decoupled IP response.

Harmonic data:
The type of data is determined by the MSF and MZF flags as described above. The number of lines varies according to the fourth value on line 5.

`15:  0.125` :Frequency, in hertz

`6.538E+01` :Real component

`-1.868E+02` :Imaginary component

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

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

DESCRIPTION OF VALUES IN SAMPLE FILE BY LINE NUMBER:

Line # Explanation:

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

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

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

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

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

9: Header line for the data that follows:

II - Command flag:

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

xxxxxxxx - X-coordinate, usually station coordinate.

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

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

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

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

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

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

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

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