CRRED
DOCUMENTATION

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

Mykle Raymond
November, 1992

Zonge Engineering & Research Organization, Inc.
3322 East Fort Lowell Road, Tucson, AZ   85716 USA
Tel:(520) 327-5501 Fax:(520) 325-1588 Email:zonge@zonge.com

TABLE OF CONTENTS

CRRED Program Documentation

OVERVIEW

CRRED provides data listings, data files with choice of data curve, plots of Real vs Imaginary, and plots of Magnitude and Phase vs Frequency.

INPUT FILES

Data files read by CRRED include an averaged data file (.S-file) and optionally a mode file (.MDE-file).

The data file is provided from 1) the CRAVG CR data averaging program, 2) the RPAVG RPIP data averaging program, or 3) the GDPHM decoupling program. The data file includes the averaged data curve for a set of frequencies, and the GDPHM program can include coupling parameters.

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 CRRED, 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 CRRED, and includes an appendix that describes modes in more detail.

OUTPUT FILES

The CRRED listing file (.CL-file) provides a page of data on each data point, including raw data. Decoupled data is also included if the GDPHM program was used to provide coupling parameters.

The intermediate .P-file includes a data curve and several parameters for each data point. The data curve is usually the same averaged data curve included in the .S-file, but several coupling curves are available if the GDPHM program was used to include coupling parameters. This file is used by the PPLOT Spectral Pseudosection plot program, which creates a composite plot of data curves for all data points in pseudosection format. The LPLOT program uses the .P-file to create a plot .Z-file with the users choice of parameters or curve data. The ZPLOT plot program is then typically used to produce contoured pseudo-sections.

The averaged data are available in plots of Real vs Imaginary components. If the GDPHM program was used to provide coupling parameters, a second plot of the decoupled data is included.

The averaged data are available in plots of Magnitude and Phase vs Frequency. If the GDPHM program was used to provide coupling parameters, a second plot of the decoupled data is included.

The averaged data are also available in pairs of plots, one of Real vs Imaginary components and the other of Magnitude and Phase vs Frequency.

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 desirable. An IP response and multiple coupling responses are usually included, in addition to measurement noise. Coupling responses are due to the measurement configuration (such as Dipole-Dipole) and geologic structure in addition to various cultural responses from pipe lines, power lines, grounded metallic fences, railroads, and so on.

The GDPHM program is used to determine coupling responses. Theoretical data curves approximating each type of coupling are generated. The parameters for these curves are iteratively adjusted until the remaining data is minimized. The approximated curve then consists of one or more theoretical coupling curves and a theoretical IP response. Removing the coupling curves leaves you 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 obtaining residual electromagnetic (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. Electromagnetic coupling is induced signal in the receiver wire caused by the electromagnetic 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 ground response is usually nearer to and sometimes greater than the inductive coupling which is decreased with increased resistivity. 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. The standard ZERO 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.

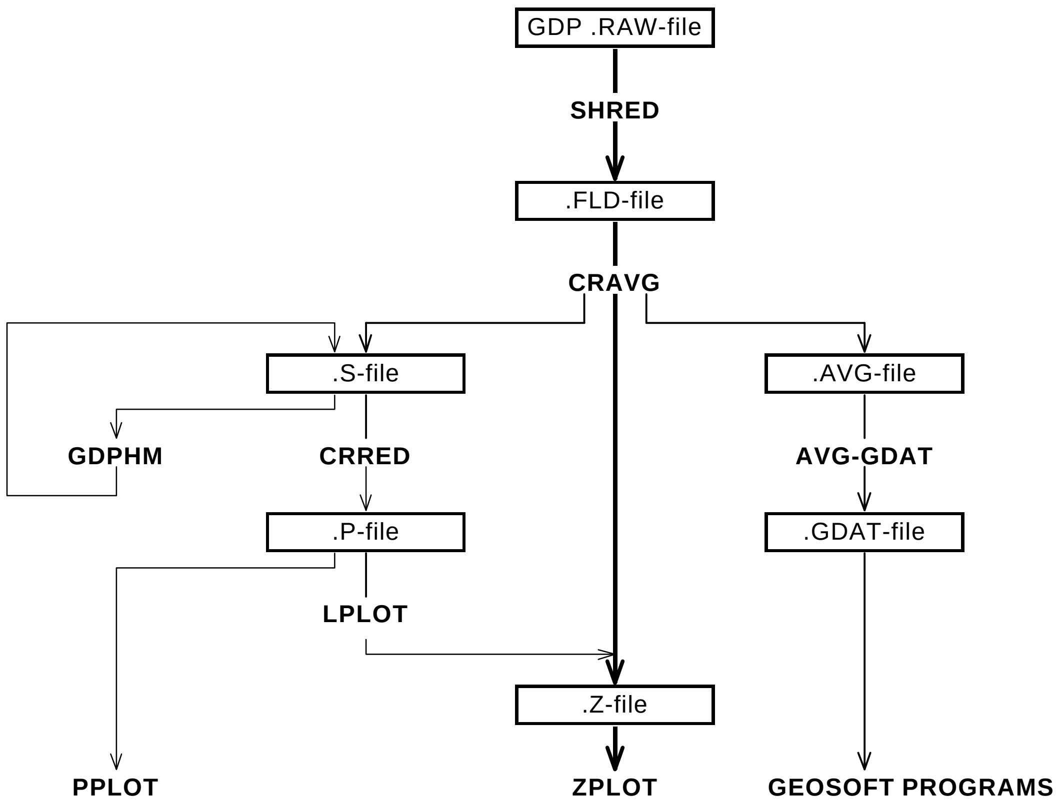
Once the ground response has been removed, the remainder is the total electromagnetic coupling. The resistivity value is then used in the theoretical equation to compute the electromagnetic coupling that would be measured for a homogeneous earth. This theoretical response is then removed from the total electromagnetic coupling data to obtain residual electromagnetic data. As mentioned above, electromagnetic 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 electromagnetic response due to resistively inconsistent geologic units.

CR DATA PROCESSING FLOW

April, 1992

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

CRRED Usage

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

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

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

CRRED MODE DISPLAY

```
PROCESSING MODES USED:
+==============+=========+=========+=========+=========+=========+=========+
|CONTROL MODES | AutoRun | Choice  | Screen  | HiFreq  |HarmLimit|         |
|   mode names | AUTO    | MENU    | VIEW    | FMAX    | HARM    |         |
|  mode values |    YES  |  NONE   |   NONE  |    ALL  |   NONE  |         |
+==============+=========+=========+=========+=========+=========+=========+
```

CRRED ERROR MESSAGES

If errors or inconsistencies arise within the program, CRRED 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.

CRRED OUTPUT SELECTIONS

CRRED will write listing (.CL-files), data (.P-files), and plot (.Xnn-files). A .LOG-file is automatically created by CRRED.

CRRED Sample Run

Input files: SAMCR.S, SAMCR.MDE
Output files: SAMCR.LOG, SAMCR.P, SAMCR.CL, SAMCR.Xnn

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

C: > CRRED

ZONGE ENGINEERING: 3322 E. Fort Lowell, Tucson AZ 85716, USA
CRRED 7.01: CR DATA LIST, CURVE PLOT, PSEUDO-SECTION FILE
   MS-DOS version implemented 01 November, 1992.

CRRED VERSION UPDATE INFORMATION
1.40 Update for GDP-16 data.
7.00 Global Modes replace .I-file.  Implement prioritized Modes.

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

MODE COMPANY =Zonge Engineering
MODE AUTO    = Yes
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
MODE FRQLO   =    1/8 Hz
MODE FRQHI   =    1/8 Hz
MODE AUTO = No

(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 | Choice  | Screen  | HiFreq  |HarmLimit|
|   mode names | AUTO    | MENU    | VIEW    | FMAX    | HARM    |
|  mode values |    YES  |  NONE   |   NONE  |    ALL  |   NONE  |
+=============+=========+=========+=========+=========+=========+

MODE Change [name?, name= value] : <CR>      *** Press RETURN        ***
```

CRRED Sample Run (continued)

```
MAIN MENU: OUTPUT OPTIONS     Choose ONE of the following:
0: EXIT
      Return to filename prompt.
1: PLOT FILE:                 .P-file for LPLOT or PPLOT.
      Choice of data output provided by menu.
2: LISTING FILE:              .L-file, one page per data point.
      Parameters and Raw Spectra data list are included.
      Decoupled points include Coupling and IP Response data.
3: SPECTRAL PLOTS:            .Xnn-file(s), one per data point.
      Plot 1: scaled to Raw Spectra data.
      Plot 2: scaled to IP Response data (decoupled points only).
4: MAG & PHZ vs FREQ PLOTS:   .Xnn-file(s), one per data point.
      Plot 1: scaled to Raw Spectra data.
      Plot 2: scaled to IP Response data (decoupled points only).
5: COMBINATION PLOTS:         .Xnn-file(s), one per data point.
      Plot 1: Spectral Plot,          scaled to Raw Spectra data.
      Plot 2: MAG & PHZ vs Freq Plot, scaled to Raw Spectra data.

Choice  [exit]: 1                           *** Select PLOT FILE    ***


PLOT FILE OUTPUT OPTIONS =====
 0: Return to Main Menu       5: Raw Partial EM
 1: RP parameters ONLY        6: Normalized Partial EM
 2: RAW data (decalibrated)   7: Total EM
 3: IP response (and noise)   8: Raw Residual EM
 4: Hilbert IP response       9: Normalized Residual EM
 5: undefined                10: Experimental Residual EM
Select  [2]: <CR>                           *** Select default RAW data

The RAW data curve is included in the .P-file for all points.
Writing plot file "SAMCR.P"

Processing . . .

 PROCESSING SUMMARY:
      54 points were successfully read.
      54 points were processed as requested.
       0 points were not processable as requested.
     434 lines were successfully read from the .S-file.

Time used:   10.2 sec.  (  0.2 min.)   Start: 13:19:27, Stop: 13:19:37
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.

CRRED MODE LIST

(v 7.0x)

PROCESSING MODE DEFAULT VALUES:

CONTROL MODES	AutoRun	Choice	Screen	HiFreq	HarmLimit	
mode names	AUTO	MENU	VIEW	FMAX	HARM	
mode values	NO	NONE	NONE	ALL	NONE	

COMPANY
Company name (40 chr max)

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

CLIENT
Client name (40 chr max)

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

PROJECT
Project name (40 chr max)

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

JOBNUMBER
Company job number (10 chr max)

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

JOBDATE
Survey date (10 chr max)

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

JOBLINE
Survey line number (10 chr max)

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

BRGLINE
Line forward bearing (10 chr max)

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

BRGBACK
Line back bearing (10 chr max)

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

STNLOW
Low station number, plot limit

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

STNHIGH
High station number, plot limit

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

STNDELT
Station number increment, plot scale

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

LBLFRST
Low station number, axis label

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

LBLDELT
Station number increment, axis label

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

FRQLO
Low frequency, plot limit

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

FRQHI
High frequency, plot limit

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

TXLEN
CSAMT Transmitter length (10 chr max)

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

TXBRG
CSAMT Transmitter bearing (10 chr max)

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

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

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

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

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

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

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

RX2TX
CSAMT Receiver to Transmitter direction

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

RXBRG
Receive dipole bearing, usually same as survey line orientation

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

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

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

PLTREV
Plot X-axis reverse selection

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

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

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

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

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

MENU

Specify one processing selection for automatic operation by CRRED.

```
MENU= 0: Default.
           Provide manual prompts and selections.
MENU= 1: PLOT FILE:                 .P-file for LPLOT or PPLOT.
           Raw Data (decalibrated) will be included in the .P-file.
MENU= 2: LISTING FILE:              .L-file, one page per data point.
           Parameters and Raw Spectra data list are included.
           Decoupled points include Coupling and IP Response data.
MENU= 3: SPECTRAL PLOTS:            .Xnn-file(s), one per data point.
           Plot 1: scaled to Raw Spectra data.
           Plot 2: scaled to IP Response data (decoupled points only).
MENU= 4: MAG & PHZ vs FREQ PLOTS:   .Xnn-file(s), one per data point.
           Plot 1: scaled to Raw Spectra data.
           Plot 2: scaled to IP Response data (decoupled points only).
MENU= 5: COMBINATION PLOTS:         .Xnn-file(s), one per data point.
           Plot 1: Spectral Plot,          scaled to Raw Spectra data.
           Plot 2: MAG & PHZ vs Freq Plot, scaled to Raw Spectra data.
```

If the mode file (.MDE-file) includes modes AUTO and MENU, and the program is started by "CRRED filename", then no prompts will be made.

Values: MENU= None, Pfile, Lstfile or plots: R/I, M/P or Combo.
Default: MENU= None

VIEW

Screen plots of data as they are written may be selected by mode VIEW.

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

FMAX

Data whose high frequency values are not usable can be ignored by setting mode FMAX to a desired high frequency.

A fundamental or harmonic frequency may be entered, in Hertz. The entry may be specified as an expression or as a numeric value, like
(1): "0.375" or "3/8"   (2) "24" or "3*8"
(3) "3072" or "3*1024"

Values: FMAX= ALL or frequency (Hz)
(fraction or numeric)
Default: FMAX= ALL

HARMONIC

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

Values: HARMONIC= NONE, 1, 3, 5, 7, or 9.
Default: HARMONIC= NONE
(same as HARMONIC= 9)

Appendix B ... SAMPLE FILES

Sample .LOG-file

```
CRRED 7.01, Processed: 24 Nov 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 | Choice  | Screen  | HiFreq  |HarmLimit|         |
|   mode names | AUTO    | MENU    | VIEW    | FMAX    | HARM    |         |
|  mode values |    YES  |  PFILE  |   NONE  |    ALL  |   NONE  |         |
+==============+=========+=========+=========+=========+=========+=========+

 Files used: "SAMCR.S" and "SAMCR.MDE"

Writing plot file "SAMCR.P"

Processing . . .

 PROCESSING SUMMARY:
      54 points were successfully read.
      54 points were processed as requested.
       0 points were not processable as requested.
     434 lines were successfully read from the .S-file.

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

Sample .S-file

```
"SAMCR.S", from CRAVG 7.01
Rx:     2. Tx:     6. NSP: 3.0
0 0 0  5  5    96.052  200.0
 SEM   1.0000E-04 1.5000E-04
 0.125 1.0000E+00 3.8000E-03
 0.375 9.9685E-01 3.4890E-03
 0.625 9.9598E-01 4.0171E-03
 0.875 9.9523E-01 2.9857E-03
 1.125 9.9411E-01 3.4794E-03
Rx:     1. Tx:     6. NSP: 4.0
0 0 0  5  5    85.855  200.0
 SEM   2.3000E-04 3.4000E-04
 0.125 1.0000E+00 2.0000E-03
 0.375 9.9791E-01 1.7630E-03
 0.625 9.9781E-01 3.0267E-03
 0.875 9.9780E-01 1.7295E-03
 1.125 9.9677E-01 2.8242E-03
Rx:     0. Tx:     6. NSP: 5.0
0 0 0  5  5    87.857  200.0
 SEM   4.0000E-04 6.4000E-04
 0.125 1.0000E+00 1.6667E-03
 0.375 9.9810E-01 1.1977E-03
 0.625 9.9952E-01 4.2313E-03
 0.875 9.9942E-01 3.1315E-03
 1.125 9.9820E-01 6.4551E-03
Rx:    -1. Tx:     6. NSP: 6.0
0 0 0  5  5   171.925  200.0
 SEM   6.0000E-04 9.7000E-04
 0.125 1.0000E+00 2.6667E-03
 0.375 9.9656E-01 3.3883E-03
 0.625 9.9726E-01 8.0115E-03
 0.875 9.9811E-01 5.4564E-03
 1.125 9.9473E-01 1.0876E-02
Rx:    -2. Tx:     6. NSP: 7.0
0 0 0  5  5   270.02   200.0
 SEM   1.0900E-03 1.2400E-03
 0.125 1.0000E+00 5.2667E-03
 0.375 9.9420E-01 4.8385E-03
 0.625 9.9494E-01 1.2603E-02
 0.875 9.9570E-01 8.1317E-03
 1.125 9.9159E-01 1.6561E-02
Rx:    -3. Tx:     6. NSP: 8.0
0 0 0  5  5   430.134  200.0
 SEM   1.1000E-03 1.6500E-03
 0.125 1.0000E+00 6.0667E-03
 0.375 9.9293E-01 6.3879E-03
 0.625 9.9387E-01 1.5472E-02
 0.875 9.9434E-01 1.0938E-02
 1.125 9.8927E-01 2.2460E-02
Rx:     2. Tx:     5. NSP: 2.0
0 0 0  5  5   105.053  200.0
 SEM   3.0000E-05 4.0000E-05
 0.125 1.0000E+00 3.1000E-03
 0.375 9.9777E-01 3.1929E-03
 0.625 9.9630E-01 3.1384E-03
 0.875 9.9545E-01 2.6877E-03
 1.125 9.9518E-01 2.4879E-03
Rx:     1. Tx:     5. NSP: 3.0
0 0 0  5  5    69.31   200.0
 SEM   1.0000E-04 1.3000E-04
 0.125 1.0000E+00 4.1500E-03
 0.375 9.9740E-01 3.6405E-03
 0.625 9.9543E-01 3.6831E-03
 0.875 9.9394E-01 2.3855E-03
 1.125 9.9465E-01 3.5310E-03
Rx:     0. Tx:     5. NSP: 4.0
0 0 0  5  5    64.962  200.0
 SEM   2.3000E-04 9.6000E-04
 0.125 1.0000E+00 3.3500E-03
 0.375 9.9681E-01 2.7911E-03
 0.625 9.9473E-01 4.1281E-03
 0.875 9.9324E-01 2.7811E-03
 1.125 9.9641E-01 3.3380E-03
```

continued next column ...

```
Rx:    -1. Tx:     5. NSP: 5.0
0 0 0  5  5    121.75   200.0
 SEM   3.6000E-04 1.0500E-03
 0.125 1.0000E+00 6.0501E-03
 0.375 9.9787E-01 6.1869E-03
 0.625 9.9388E-01 6.9076E-03
 0.875 9.8882E-01 4.1036E-03
 1.125 9.9245E-01 8.9323E-03
Rx:    -2. Tx:     5. NSP: 6.0
0 0 0  5  5   186.783  200.0
 SEM   6.0000E-04 7.8000E-04
 0.125 1.0000E+00 7.8002E-03
 0.375 9.9635E-01 7.1240E-03
 0.625 9.8996E-01 9.1574E-03
 0.875 9.8432E-01 4.7248E-03
 1.125 9.9132E-01 1.0806E-02
Rx:    -3. Tx:     5. NSP: 7.0
0 0 0  5  5   294.275  200.0
 SEM   7.7000E-04 1.0400E-03
 0.125 1.0000E+00 8.8502E-03
 0.375 9.9625E-01 8.3687E-03
 0.625 9.8784E-01 1.1311E-02
 0.875 9.8036E-01 5.2940E-03
 1.125 9.8879E-01 1.3152E-02
Rx:     2. Tx:     4. NSP: 1.0
0 0 0  5  5   133.897  200.0
 SEM   1.0000E-05 1.0000E-05
 0.125 1.0000E+00 1.7000E-03
 0.375 9.9855E-01 1.9472E-03
 0.625 9.9779E-01 1.8459E-03
 0.875 9.9727E-01 1.7452E-03
 1.125 9.9668E-01 1.3954E-03
Rx:     1. Tx:     4. NSP: 2.0
0 0 0  5  5    89.295  200.0
 SEM   3.0000E-05 3.0000E-05
 0.125 1.0000E+00 4.2000E-03
 0.375 9.9689E-01 3.9876E-03
 0.625 9.9559E-01 3.7335E-03
 0.875 9.9463E-01 3.6802E-03
 1.125 9.9360E-01 3.4279E-03
Rx:     0. Tx:     4. NSP: 3.0
0 0 0  5  5    84.754  200.0
 SEM   1.0000E-04 1.5000E-04
 0.125 1.0000E+00 5.1000E-03
 0.375 9.9650E-01 4.6337E-03
 0.625 9.9512E-01 4.8761E-03
 0.875 9.9394E-01 4.8207E-03
 1.125 9.9313E-01 6.1078E-03
Rx:    -1. Tx:     4. NSP: 4.0
0 0 0  5  5   164.601  200.0
 SEM   1.1000E-04 1.4000E-04
 0.125 1.0000E+00 7.0501E-03
 0.375 9.9493E-01 7.1139E-03
 0.625 9.9284E-01 6.9003E-03
 0.875 9.9180E-01 7.3891E-03
 1.125 9.8954E-01 7.8176E-03
Rx:    -2. Tx:     4. NSP: 5.0
0 0 0  5  5   256.177  200.0
 SEM   1.8000E-04 2.5000E-04
 0.125 1.0000E+00 9.5503E-03
 0.375 9.9291E-01 9.5819E-03
 0.625 9.9029E-01 9.2594E-03
 0.875 9.8872E-01 9.8875E-03
 1.125 9.8497E-01 1.0786E-02
Rx:    -3. Tx:     4. NSP: 6.0
0 0 0  5  5   412.136  200.0
 SEM   2.3000E-04 3.2000E-04
 0.125 1.0000E+00 1.0900E-02
 0.375 9.9220E-01 1.0815E-02
 0.625 9.8910E-01 1.0435E-02
 0.875 9.8733E-01 1.1552E-02
 1.125 9.8250E-01 1.2822E-02
```

continued next column ...

```
Rx:     1. Tx:     3. NSP: 1.0
0 0 0  5  5    88.347  200.0
 SEM   2.0000E-05 2.0000E-05
 0.125 1.0000E+00 2.0500E-03
 0.375 9.9839E-01 2.1465E-03
 0.625 9.9752E-01 2.0449E-03
 0.875 9.9698E-01 1.6949E-03
 1.125 9.9650E-01 1.6442E-03
Rx:     0. Tx:     3. NSP: 2.0
0 0 0  5  5    89.501  200.0
 SEM   1.4000E-04 1.4000E-04
 0.125 1.0000E+00 3.9500E-03
 0.375 9.9741E-01 3.9398E-03
 0.625 9.9621E-01 4.2339E-03
 0.875 9.9732E-01 6.5325E-03
 1.125 9.9441E-01 7.0107E-03
Rx:    -1. Tx:     3. NSP: 3.0
0 0 0  5  5   193.83   200.0
 SEM   1.6000E-04 1.7000E-04
 0.125 1.0000E+00 5.6001E-03
 0.375 9.9589E-01 5.6766E-03
 0.625 9.9411E-01 6.3624E-03
 0.875 9.9348E-01 6.9545E-03
 1.125 9.9126E-01 7.6328E-03
Rx:    -2. Tx:     3. NSP: 4.0
0 0 0  5  5   323.229  200.0
 SEM   2.5000E-04 6.0000E-04
 0.125 1.0000E+00 8.0002E-03
 0.375 9.9430E-01 7.6066E-03
 0.625 9.9183E-01 8.4804E-03
 0.875 9.9067E-01 9.0153E-03
 1.125 9.8691E-01 9.1785E-03
Rx:    -3. Tx:     3. NSP: 5.0
0 0 0  5  5   553.527  200.0
 SEM   4.0000E-04 9.5000E-04
 0.125 1.0000E+00 1.0350E-02
 0.375 9.9197E-01 1.0069E-02
 0.625 9.8868E-01 1.0579E-02
 0.875 9.8777E-01 1.1656E-02
 1.125 9.8339E-01 1.3867E-02
Rx:     0. Tx:     2. NSP: 1.0
0 0 0  5  5   130.331  200.0
 SEM   1.0000E-04 1.2000E-04
 0.125 1.0000E+00 4.5000E-04
 0.375 9.9918E-01 3.9967E-04
 0.625 9.9758E-01-1.4964E-04
 0.875 9.9830E-01-7.4872E-04
 1.125 9.9660E-01-1.7441E-03
Rx:    -1. Tx:     2. NSP: 2.0
0 0 0  5  5   336.156  200.0
 SEM   4.0000E-05 4.0000E-05
 0.125 1.0000E+00 2.8500E-03
 0.375 9.9788E-01 3.3429E-03
 0.625 9.9672E-01 3.6879E-03
 0.875 9.9551E-01 3.4843E-03
 1.125 9.9538E-01 3.5834E-03
Rx:    -2. Tx:     2. NSP: 3.0
0 0 0  5  5   602.329  200.0
 SEM   1.0000E-04 1.0000E-04
 0.125 1.0000E+00 6.2501E-03
 0.375 9.9547E-01 7.1675E-03
 0.625 9.9335E-01 7.7483E-03
 0.875 9.9104E-01 7.5816E-03
 1.125 9.9052E-01 8.0729E-03
Rx:    -3. Tx:     2. NSP: 4.0
0 0 0  5  5  1125.703  200.0
 SEM   1.4000E-04 1.7000E-04
 0.125 1.0000E+00 7.8502E-03
 0.375 9.9455E-01 8.9014E-03
 0.625 9.9182E-01 1.0167E-02
 0.875 9.8851E-01 9.6878E-03
 1.125 9.8790E-01 1.0867E-02
```

continued next page ...

Sample .S-file (page 2)

```
Rx:   -1. Tx:    1. NSP: 1.0
0 0 0  5  5   134.45   200.0
 SEM   1.0000E-05 2.0000E-05
 0.125 1.0000E+00 1.1000E-03
 0.375 9.9909E-01 1.5486E-03
 0.625 9.9851E-01 1.6975E-03
 0.875 9.9821E-01 1.8467E-03
 1.125 9.9780E-01 1.7960E-03
Rx:   -2. Tx:    1. NSP: 2.0
0 0 0  5  5   284.702  200.0
 SEM   2.0000E-05 3.0000E-05
 0.125 1.0000E+00 4.5500E-03
 0.375 9.9654E-01 5.4312E-03
 0.625 9.9478E-01 5.9687E-03
 0.875 9.9364E-01 6.0613E-03
 1.125 9.9259E-01 6.1541E-03
Rx:   -3. Tx:    1. NSP: 3.0
0 0 0  5  5   618.171  200.0
 SEM   3.0000E-05 4.0000E-05
 0.125 1.0000E+00 6.5001E-03
 0.375 9.9533E-01 7.5646E-03
 0.625 9.9282E-01 8.3895E-03
 0.875 9.9124E-01 8.9710E-03
 1.125 9.9012E-01 9.2084E-03
Rx:    5. Tx:    1. NSP: 3.0
0 0 0  5  5    66.619  200.0
 SEM   5.1000E-04 7.8000E-04
 0.125 1.0000E+00 5.8001E-03
 0.375 9.9692E-01 3.3895E-03
 0.625 9.9488E-01 3.0178E-03
 0.875 9.9359E-01 4.1731E-03
 1.125 9.9283E-01 3.7397E-03
Rx:    6. Tx:    1. NSP: 4.0
0 0 0  5  5    82.479  200.0
 SEM   1.9000E-04 2.0000E-04
 0.125 1.0000E+00 2.2333E-03
 0.375 9.9849E-01 2.5295E-03
 0.625 9.9759E-01 3.2921E-03
 0.875 9.9834E-01 2.9617E-03
 1.125 9.9661E-01 3.7539E-03
Rx:    7. Tx:    1. NSP: 5.0
0 0 0  5  5   114.302  200.0
 SEM   2.8000E-04 4.0000E-04
 0.125 1.0000E+00 2.9667E-03
 0.375 9.9752E-01 4.0898E-03
 0.625 9.9677E-01 5.3161E-03
 0.875 9.9851E-01 5.0259E-03
 1.125 9.9412E-01 7.6880E-03
Rx:    8. Tx:    1. NSP: 6.0
0 0 0  5  5   149.739  200.0
 SEM   4.9000E-04 5.7000E-04
 0.125 1.0000E+00 4.1000E-03
 0.375 9.9677E-01 5.6152E-03
 0.625 9.9567E-01 7.6336E-03
 0.875 9.9737E-01 7.2476E-03
 1.125 9.9291E-01 1.0128E-02
Rx:    9. Tx:    1. NSP: 7.0
0 0 0  5  5   166.572  200.0
 SEM   6.1000E-04 6.9000E-04
 0.125 1.0000E+00 5.0667E-03
 0.375 9.9587E-01 6.9712E-03
 0.625 9.9414E-01 1.0041E-02
 0.875 9.9693E-01 9.0723E-03
 1.125 9.9087E-01 1.2915E-02
Rx:    5. Tx:    2. NSP: 2.0
0 0 0  5  5   113.827  200.0
 SEM   6.2000E-04 6.7000E-04
 0.125 1.0000E+00 3.1000E-03
 0.375 9.9642E-01 3.7366E-03
 0.625 9.9685E-01 1.8940E-03
 0.875 9.9562E-01 3.6340E-03
 1.125 9.9418E-01 3.7779E-03
```

continued next column ...

```
Rx:    6. Tx:    2. NSP: 3.0
0 0 0  5  5   102.88    200.0
 SEM   2.5000E-04 3.1000E-04
 0.125 1.0000E+00 3.6500E-03
 0.375 9.9698E-01 4.0378E-03
 0.625 9.9536E-01 3.7824E-03
 0.875 9.9424E-01 4.1758E-03
 1.125 9.9206E-01 5.7044E-03
Rx:    7. Tx:    2. NSP: 4.0
0 0 0  5  5   137.629  200.0
 SEM   5.0000E-04 8.0000E-04
 0.125 1.0000E+00 4.9500E-03
 0.375 9.9577E-01 5.1283E-03
 0.625 9.9279E-01 6.2547E-03
 0.875 9.9166E-01 7.3384E-03
 1.125 9.8747E-01 1.1208E-02
Rx:    8. Tx:    2. NSP: 5.0
0 0 0  5  5   180.672  200.0
 SEM   7.8000E-04 1.1500E-03
 0.125 1.0000E+00 6.0501E-03
 0.375 9.9449E-01 7.5085E-03
 0.625 9.9138E-01 7.9312E-03
 0.875 9.8947E-01 1.0340E-02
 1.125 9.8222E-01 1.6355E-02
Rx:    9. Tx:    2. NSP: 6.0
0 0 0  5  5   201.98    200.0
 SEM   1.0400E-03 1.7100E-03
 0.125 1.0000E+00 6.8001E-03
 0.375 9.9322E-01 8.9889E-03
 0.625 9.8960E-01 9.4509E-03
 0.875 9.8704E-01 1.3375E-02
 1.125 9.7666E-01 2.2418E-02
Rx:    5. Tx:    3. NSP: 1.0
0 0 0  5  5   118.451  200.0
 SEM   2.0000E-05 3.0000E-05
 0.125 1.0000E+00 1.1333E-03
 0.375 9.9886E-01 1.1653E-03
 0.625 9.9830E-01 9.3174E-04
 0.875 9.9797E-01 5.9878E-04
 1.125 9.9740E-01 6.6493E-05
Rx:    6. Tx:    3. NSP: 2.0
0 0 0  5  5    77.889  200.0
 SEM   8.0000E-05 9.0000E-05
 0.125 1.0000E+00 3.2000E-03
 0.375 9.9764E-01 3.0262E-03
 0.625 9.9648E-01 2.8234E-03
 0.875 9.9552E-01 2.4888E-03
 1.125 9.9450E-01 1.6244E-03
Rx:    7. Tx:    3. NSP: 3.0
0 0 0  5  5    90.974  200.0
 SEM   2.3000E-04 3.0000E-04
 0.125 1.0000E+00 5.5001E-03
 0.375 9.9560E-01 6.0401E-03
 0.625 9.9286E-01 6.0234E-03
 0.875 9.9203E-01 5.7538E-03
 1.125 9.9102E-01 4.2284E-03
Rx:    8. Tx:    3. NSP: 4.0
0 0 0  5  5   116.43    200.0
 SEM   4.2000E-04 5.0000E-04
 0.125 1.0000E+00 6.9001E-03
 0.375 9.9449E-01 7.5251E-03
 0.625 9.9169E-01 7.6361E-03
 0.875 9.9019E-01 7.6577E-03
 1.125 9.8609E-01 3.8458E-03
Rx:    9. Tx:    3. NSP: 5.0
0 0 0  5  5   126.677  200.0
 SEM   7.1000E-04 8.1000E-04
 0.125 1.0000E+00 7.8002E-03
 0.375 9.9380E-01 8.5469E-03
 0.625 9.9065E-01 9.1142E-03
 0.875 9.8868E-01 9.6894E-03
 1.125 9.8287E-01 3.2435E-03
```

continued next column ...

```
Rx:    6. Tx:    4. NSP: 1.0
0 0 0  5  5   105.289  200.0
 SEM   1.0000E-05 2.0000E-05
 0.125 1.0000E+00 5.5000E-04
 0.375 9.9859E-01-1.5977E-03
 0.625 9.9770E-01-3.9409E-03
 0.875 9.9725E-01-6.5819E-03
 1.125 9.9691E-01-8.9226E-03
Rx:    7. Tx:    4. NSP: 2.0
0 0 0  5  5   118.16    200.0
 SEM   8.0000E-05 2.5000E-04
 0.125 1.0000E+00 3.9500E-03
 0.375 9.9687E-01 4.8847E-03
 0.625 9.9551E-01 4.8781E-03
 0.875 9.9553E-01 4.9777E-03
 1.125 9.9430E-01 4.8721E-03
Rx:    8. Tx:    4. NSP: 3.0
0 0 0  5  5   154.637  200.0
 SEM   1.2000E-04 1.6000E-04
 0.125 1.0000E+00 6.3001E-03
 0.375 9.9515E-01 7.4638E-03
 0.625 9.9252E-01 8.1388E-03
 0.875 9.9200E-01 7.8370E-03
 1.125 9.9054E-01 8.7665E-03
Rx:    9. Tx:    4. NSP: 4.0
0 0 0  5  5   176.787  200.0
 SEM   2.1000E-04 2.7000E-04
 0.125 1.0000E+00 7.5501E-03
 0.375 9.9405E-01 9.3443E-03
 0.625 9.9074E-01 1.0403E-02
 0.875 9.9099E-01 9.6129E-03
 1.125 9.8905E-01 1.1424E-02
Rx:    7. Tx:    5. NSP: 1.0
0 0 0  5  5   122.581  200.0
 SEM   5.0000E-05 3.4000E-04
 0.125 1.0000E+00 3.2000E-03
 0.375 9.9721E-01 2.7257E-03
 0.625 9.9605E-01 3.3866E-03
 0.875 9.9503E-01 3.9470E-03
 1.125 9.9393E-01 3.9426E-03
Rx:    8. Tx:    5. NSP: 2.0
0 0 0  5  5   174.9     200.0
 SEM   6.0000E-05 7.0000E-05
 0.125 1.0000E+00 5.5001E-03
 0.375 9.9570E-01 6.4721E-03
 0.625 9.9338E-01 6.8875E-03
 0.875 9.9175E-01 7.3391E-03
 1.125 9.9091E-01 7.3328E-03
Rx:    9. Tx:    5. NSP: 3.0
0 0 0  5  5   219.989  200.0
 SEM   1.2000E-04 1.6000E-04
 0.125 1.0000E+00 6.8668E-03
 0.375 9.9462E-01 8.2887E-03
 0.625 9.9156E-01 8.9904E-03
 0.875 9.9000E-01 9.7683E-03
 1.125 9.8912E-01 1.0551E-02
Rx:    8. Tx:    6. NSP: 1.0
0 0 0  5  5   254.35    200.0
 SEM   2.0000E-05 3.0000E-05
 0.125 1.0000E+00 5.5501E-03
 0.375 9.9555E-01 6.0232E-03
 0.625 9.9294E-01 5.9577E-03
 0.875 9.9127E-01 5.4520E-03
 1.125 9.8995E-01 4.7518E-03
Rx:    9. Tx:    6. NSP: 2.0
0 0 0  5  5   349.726  200.0
 SEM   3.0000E-05 5.0000E-05
 0.125 1.0000E+00 7.6001E-03
 0.375 9.9419E-01 9.0474E-03
 0.625 9.9095E-01 9.7116E-03
 0.875 9.8877E-01 9.8880E-03
 1.125 9.8705E-01 1.0019E-02
```

*** end of file ***

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 ...

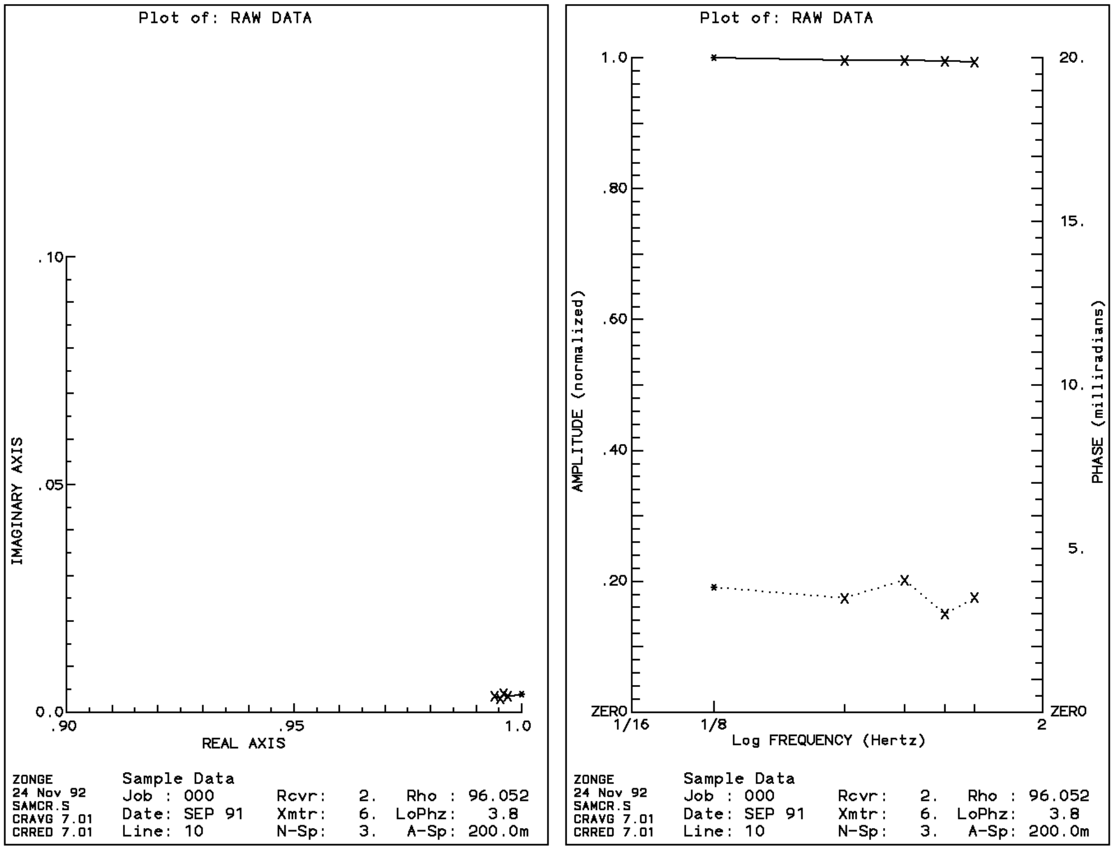
```
Rx:   8.  Tx:   5.  NSp: 2.
1 0 0  5   174.9     0.9   0.0
   5.5   4.8   5.9   4.6   0.0
   0.1   0.1   4.7   4.5   0.0
  0.125  1.000E+00  5.500E-03
  0.375  9.957E-01  6.472E-03
  0.625  9.934E-01  6.888E-03
  0.875  9.918E-01  7.339E-03
  1.125  9.909E-01  7.333E-03
Rx:   9.  Tx:   5.  NSp: 3.
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 .CL-file (first page only)

```
Sample Data                                               CRRED 7.01 data summary

Rcvr:   2.   Job : 000            Processed: 24 Nov 92

Xmtr:   6.   Date: SEP 91         A-Spacing:  200.0m

NSp:    3.   Line: 10             Apparent Resistivity:    96.052 o-m


0.125 Hz phase       :  RAW=    3.8 mr.
0.125 Hz to 1. Hz PFE:  RAW=    0.5 %
3 point DC phase     :  RAW=    4.3 mr.

Std Error of the MEAN:  MIN=    0.1 mr.,
                        MAX=    0.2 mr.


                 RAW DATA

 Freq (Hz)     Real    Imag

    0.125    1.0000  0.0038

    0.375    0.9969  0.0035

    0.625    0.9960  0.0040

    0.875    0.9952  0.0030

    1.125    0.9941  0.0035
```

Sample .Xnn-file Combination Plot SAMCR.X01



Appendix C ... FILE DOCUMENTATION

.S-file Format (v2.0)   CR / RPIP Averaged Data File

```
 1:  "936L50S.S", from CRAVG 5.00
 2:  Rx:  2.0  Tx:  4.0  NSP: 1.0
 3:  1 0 4 18 18      82.7  588.0
 4:   SEM   0.0000E+00 0.0000E+00
 5:    1.4219  0.0693  171.
 6:    0.0747  0.2285  15.7
 7:    0.0426  0.4133  4.80
 8:   -0.0026  1.4776 0.375
 9:     2.955  -0.306   0.719
10:   0.125 1.0000E 00 5.7426E-03
      0.375 9.9734E-01 1.1810E-02
      0.625 9.9471E-01 1.7281E-02
      0.875 9.9243E-01 2.2393E-02
      1.125 9.8993E-01 2.6757E-02
      1.375 9.8754E-01 3.1019E-02
      1.000 9.9118E-01 2.4446E-02
      3.000 9.7520E-01 5.1194E-02
      5.000 9.6105E-01 7.4148E-02
      7.000 9.4681E-01 8.9063E-02
      9.000 9.3649E-01 1.0505E-01
     11.000 9.2290E-01 1.1720E-01
      8.000 9.4165E-01 9.7557E-02
     24.000 8.6712E-01 1.7926E-01
     40.000 8.0799E-01 2.3717E-01
     56.000 7.5174E-01 2.8224E-01
     72.000 6.9981E-01 3.1128E-01
     88.000 6.5208E-01 3.3569E-01
```

DESCRIPTION OF SAMPLE FILE VALUES, BY LINE NUMBER:

The .S-file is composed of a two line header, followed by blocks of data, each containing data for one pseudosection data point. Each block begins with a line indicating 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. The data in this file are always raw, averaged, decalibrated field data normalized to the low frequency real component.

1. File header line generated by the averaging program.

   NOTE: Header line 1 occurs only at the beginning of the file.

2. Rx and Tx indicate the receiver and transmitter dipoles that were used for this block. 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.

   N-SP = N-Spacing = the number of A-Spacings between transmitter and receiver dipoles.

3. 1 Comm wire flag (0 = white wire #2, 1 = black wire (W21C)
   0 Times to pass the data curve through a harmonic filter
   4 Levels of coupling coefficients
   18 Harmonics to use when decoupling
   18 Harmonics in data block array
   82.7 Apparent Resistivity, RHO (ohmmeters)
   588.0 A-Spacing (meters).
   (Values included for LAB rock measurements are noted below)

RHO: dipole-dipole resistivity in ohmmeters =

```
 MAG      C      ASPACING
----- * ------ * -------- * pi * NSP * [NSP + 1] * [NSP + 2]
 4/pi   FPGAIN     CRT
```

MAG = raw Fourier magnitude, in volts
4/pi corrects MAG from the Fourier magnitude to the Square-Wave magnitude
C = Communications-wire attenuation
This corrects for the voltage drop that occurs in the wire between the field preamp and the GDP
FPGAIN = field preamp gain
ASPACING = the A-Spacing, in meters
CRT = Current, in amps
NSP = N-Spacing

Comm-wire attenuation factors at 0.125 Hz (W21C wire)
The GDP is not concerned with these factors.

#Reels	Attenuation	#Reels	Attenuation
0	1.0000	5	1.2585
1	1.0505	6	1.3116
2	1.1025	7	1.3635
3	1.1542	8	1.4160
4	1.2070		

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

RHO: laboratory rock measurements in ohmmeters =

```
 MAG     1     AREA      1 m
----- * --- * ------ * ------
 4/pi   CRT   LENGTH   100 cm
```

MAG = raw Fourier magnitude, in volts
4/pi corrects MAG from the Fourier magnitude to the Square-Wave magnitude
CRT = Current, in microAmps
LENGTH = Length of rock sample, in cm
AREA =Area of rock sample, in cm*cm

NOTE: for laboratory rock measurements, RESISTOR, LENGTH, AREA, and CRT are included on this data line, following the A-Spacing.

4. Minimum and maximum SEM values, respectively. SEM: Standard Error of the Mean for Channel 1 (receiver dipole), at the fundamental frequency, in radians (for frequencies of 1.0 Hz and below only)

5,6,7,8. Coupling coefficients, levels 1, 2, 3, 4, respectively. The number of levels varies according to the third value on line 4, as determined during manual decoupling. If the third number on line 4 is zero, the station has not been manually decoupled.

9. Hilbert response parameters: phase, slope 1, and slope 2.

10. The following lines are harmonic data with the 1st, 2nd and 3rd columns listing frequency, real and imaginary components, respectively. The number of lines varies according to the fourth value on line 4.

.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:

```
  MG1       C        ASPACING
(----- * ------) * -------- * π * NSP * (NSP + 1) * (NSP + 2)
  4/π    FPGAIN       CRT
```

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