Documentation for
MPT/DAS-1 & ERT2008
Autonomous Data Collection
Version 9

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DATA COLLECTION SOFTWARE

OVERVIEW

This document contains instructions for installation and operation of the MPT data collection system and Autonomous Data Collection System. The MPT/DAS-1 or ERT 2008 system description including hardware hookup, data, topology and schedule file descriptions are documented separately. The two documents are designed to complement one another.

The software system has evolved to include the following applications:

1) MPTFieldOpt is the software for manual, real-time operation of the system;
2) MPTRemote is the version of the operation software designed to be run in the background;
3) MPTScheduler is the control routine for autonomous data collection that, depending on its configuration, launches MPTRemote, MPTStatusUpload, and MPTDataUpload;
4) MPTStatusUpload is an optional routine that allows the system to communicate status information and configuration files through a web site using FTP protocol;
5) MPTDataUpload is an optional routine that the system uses to upload data to a web site or other internet server using FTP;
6) MPTOffice is a utility for configuring and monitoring autonomous data collection either through an FTP server or a direct network (wireless, hardwired, or dialup) connection;
7) MPTSchedulerConfiguration is a utility for creating an initial configuration for the MPTScheduler; and
8) MPTTopologyFileMaker is a utility for building topology files; these are the files that tell the system how the multiplexers are configured and how they are connected.

The MPT Autonomous data collection system is a collection of four different executables/applications which work together to collect data at pre-determined intervals and upload the data and system status to a web site using FTP protocol.   A fifth routine, MPTOffice is used to aid the user in creating Command Files for the DAS-1 or Batch Files for the ERT2008 which contain the information needed to control and complete a data run and to schedule data runs. The system can be configured to run completely autonomously collecting data at pre-specified intervals but can be remotely monitored and updated if communication is available, either through a network connection (either hardwired, dialup, or virtual private network) or through FTP (File Transfer Protocol). The actual communication between the various applications and between the office and remote systems uses a series of file commands.

System Requirements

The installation program requires Microsoft Windows 98 or later, at least 30MB of hard disk space available, a 300 MHz or faster processor, a 2x (or faster) CDROM drive.

A few notes before starting: the system (PC) that performs the data collection (the one that is hooked to the DAS-1 or ERT2008 Systems) is referred to as the FIELD or REMOTE system. Any other system is referred to as the OFFICE or LOCAL system. In each case the two terms described may be used interchangeably.

One or more systems (PC's) may use the batch file creation program or MPTOffice to schedule data collection activities. To allow the OFFICE system access, the FIELD system must be accessible to the business network. This accessibility may be achieved through RAS dialup or other network connectivity that supports peer to peer networking and drive mapping. Network protocol is not important but TCP/IP is recommended. If it is possible to map a remote drive on the FIELD system then the MPT Autonomous software should work. Alternatively, access through an intermediary FTP site is possible.

System Installation

From the MPT/DAS-1 or ERT2008 Software Installation Disc:

Open "Setup.bat"

Follow instructions for installation of the following 8 programs:

We recommend using the C:\MPTERTField\ destination directory created by the installation program.

MPTBackground.exe
MPTERTFTPDataUpload.exe
MPTERTFTPStatusUpload.exe
MPTFieldOPT.exe
MPTOffice.exe
MPTScheduler.exe
MPTSchedulerConfigure.exe
MPTTopologyMaker.exe

In your computer's Programs directory, open MPTSchedulerConfigure.exe. These are your default configuration settings and may be changed if needed (if using FTP, your settings will need to be entered here). In addition, the type of system being used (old system or DAS-1) should be specified by checking or un-checking the DAS-1 System box. If settings are changed, or new settings are added you must first select "update configuration" and then you will be able

to select "write configuration file". The recommended location for the .cfg file is C:\MPTERTFeld\System_Config\ directory.

Instructions for the DAS-1 system:

Next, open the MPTScheduler program to access the Field Monitor window, which will display any scheduled data runs. The Field Monitor must be open on the Field System in order to collect data, but should not be open on the Office system.

It is recommended that you then create a Command file. The Command file contains commands for each specific data run (i.e. number of stacks, delay time, which schedule file to use, etc). The Command file can be created using the following method:

1. Using MPTOffice.exe; Follow instructions to load a configuration file. Then go to the Field System pull-down menu and select the desired data acquisition mode. In this window you can load a Schedule file and enter system command settings. When you are finished updating the command settings, click "update configuration" and then click "save command file". If you would like to schedule a job to run, open the desired command file and select "schedule as job." From the following menu, select the desired scheduling settings and then click "schedule job." The new data run should appear on the Field Monitor screen on the Field System.

Instructions for the ERT2008 system:

To collect data, you will first need to create a Topology file using the MPTTopologyMaker. You will also need to create a Schedule file (see Appendix A for sample Schedule file).

It is recommended that you then create a Batch file. The Batch file contains commands for each specific data run (i.e. number of stacks, delay time, which schedule and topology file to use, etc). An example of the Batch file structure is in Appendix B. Batch files can be created two ways:

2. Using MPTOffice.exe; Follow instructions to load a configuration file. Then go to the Field System pull-down menu and select Batch Defaults. In this window you can load your Schedule file, Topology file and enter system command settings. When you are finished go to the File menu and save your batch file. If you would like to schedule a job to run, check the appropriate settings under "Scheduling Options " (in the Batch Defaults window); and select "Schedule a job using the loaded Batch File" from the pull-down menu.

3. Using MPTFieldOPT.exe; Go to the Data Collection tab, select Collect Data. This will bring up a configuration form where you can enter system settings and select Topology and Schedule files. When you are finished go to the File menu and save your Batch file.

To automatically run the Scheduler Program upon start-up and/or reboot of PC:

Go to the MPTERTField directory created by the installation software. Open the System_Config directory, create a shortcut to the Scheduler by right clicking on MPTScheduler.exe and selecting Copy. Right click the Windows "Start" button and select Explore. Open the Startup folder (located in the Programs directory), right click and select past shortcut while inside the Startup folder.

Explanation of Configuration Parameters

The following parameters are used for both Standard Operation and Remote Operation of the ERT system (a sample Configuration file is located in Appendix A):

Default refresh/update rates

UPDATE RATE (ms): This parameter indicates how frequently the scheduler program will check the schedule for work to be performed. Typical intervals are 1000 to 5000 milliseconds.

MAXIMUM STATUS UPDATE TIME: This is the maximum time between updates of the system status file in seconds. Normally, the background data collection routine updates this file about every 10 data points.   The scheduler routine watches this file to determine if the system is running properly or is hung up. If the status is not updated for long periods of time, the scheduler will kill the run and restart it later. The default is 60 seconds and may need to be increased for low frequencies or long stack times. In any case the time must be much greater than the time for 10 data points to be collected.

Directories

Note: Directory names should end with a backslash (i.e."CMD\")

COMMAND FILE DIRECTORY: This directory is used to contain the site command files for each individual data acquisition mode, and is sorted into the appropriate folders. The default value is CMD\. The default location is C:\MPTERTField*\CMD where * is the acquisition mode (i.e. TDIP, STREAM, etc…).

BATCH FILE DIRECTORY: This directory is used to contain the site batch files. The default value is Batch\. The default location is C:\MPTERTField\Batch\.

TOPOLOGY FILE DIRECTORY: This directory is used to contain the site topology files. The default value is Topology\. The default location is C:\MPTERTField\Topology\.

SCHEDULE FILE DIRECTORY: This directory is used to contain the site schedule files. The default value is Schedule\. The default location is C:\MPTERTField\Schedule\.

DATA OUTPUT DIRECTORY for DAS-1: This directory is used to contain the site data output files for each individual data acquisition mode, and is sorted into the appropriate folders.. The default value is Data\. The default location is C:\MPTERTfield\Data where * is the acquisition mode (i.e. TDIP, STREAM, etc…).

*DATA OUTPUT DIRECTORY for ERT2008: This directory is used to contain the site data output files. The default value is Output\. The default location is C:\MPTERTfield\Output\.

MPT recommends that this directory be placed on a drive with at least 100 MB of free space

SCHEDULER CONFIGURATION FILE DIRECTORY: This directory contains configuration files (extension .cfg) and the MPTScheduler (used for remote operation). The default location is "C:\MPTERTField\System_Config\".

SCHEDULER INSTRUCTIONS DIRECTORY: This directory contains the command file (default name: MPTERT_command.stt) The MPTERTBackground executable monitors this file to see if it contains the command STOP. In this case it suspends the current data collection.
The default location is "C:\MPTERTField\SchedulerInstructions\".

SCHEDULER TODO LIST FILE DIRECTORY: This directory contains the ToDoList (default name: MPT_TODO.lst; default location:C:\MPTERTField\ToDo\)   (extension .lst) This file contains the list of pending data acquisition jobs.   Note that due to some rather unfortunate historical terminology the "Schedule_File" (see Appendix A) contains the list of electrode arrays for a given data run so we use the term ToDo file to indicate the list of jobs and scheduled dates and intervals.

REMOTE EXECUTABLE DIRECTORY: This directory contains all executable files (extension.exe),   *except*   MPTScheduler,   (which   is   located   in "C:\MPTERTField\System_Config\"). The default location is "C:\MPTERTField\Remote\".

STATUS FILES DIRECTORY: This directory contains Status files (extension .stt).The default location is "C:\MPTERTField\Status\".

DATA STREAM DIRECTORY: This directory contains the CMD and Data folders for the data stream acquisition mode. The default location is C:\MPTERTField\STREAM

FREQUENCY-DOMAIN IP: This directory contains the CMD and Data folders for the Frequency-Domain IP acquisition mode. The default location is C:\MPTERTField\FDIP

SELF-POTENTIAL: This directory contains the CMD and Data folders for the Self-Potential acquisition mode. The default location is C:\MPTERTField\SP

SPECTRAL IP: This directory conatins the CMD and Data folders for the Spectral IP acquisition mode. The default location is C:\MPTERTField\SPECTRAL

TIME-DOMAIN IP: This directory contains the CMD and Data folders for the Time-Domain IP acquisition mode. The default location is C:\MPTERTField\TDIP

1. MainStatusFile (default name: MPTERT_Status1.stt) The MPTERTBackground application continuously updates this file with system progress and any error conditions. The MPTScheduler monitors this file to determine if the current job is active or has become stalled.   If FTP is used, this file is periodically uploaded to the FTP site by the FTPStatusUploader.

2. OutputStatusFile (default name: MPTERT_Status2.stt) The MPTERTBackground application periodically writes copies of the last 20 data values to this file. This file can be used by the user to monitor progress of the data run.   If FTP is used, this file is periodically uploaded to the FTP site by the FTPStatusUploader.

3. SystemStatusFile (default name: MPTSystemStatus.stt) The MPTERTBackground application periodically writes this file whenever the system begins or ends a data run. If FTP is used, this file is periodically uploaded to the /Status/ subdirectory on the FTP site by the FTPStatusUploader.

FTP LOCAL DATA DIRECTORY: This directory contains stored copies of data files waiting to upload. The default location is "C:\MPTERTField\FTP\Data".

FTP TEMPORARY FILE DIRECTORY: This directory contains temporary non-data files being uploaded. The default location is "C:\MPTERTField\FTP\Temp".

Default Filenames

TO DO LIST FILENAME:	"MPTERT_TODO.lst"
DATA COLLECTION BACKGROUND EXECUTABLE:	"MPTBackground.exe"
DATA COLLECTION REMOTE WINDOW:	"MPTBackground"
CONFIGURATION FILE NAME:	"MPTFieldMonitor.cfg"
FIELD MONITOR INSTRUCTIONS FILE	"MPTERT_RemoteInstruction.inst"
BACKGROUND EXECUTABLE INSTRUCTIONS FILE:	"MPTERT_BackgroundInstruction.binst"
SYNCHRONIZATION_FILENAME:	"MPTERTSynchronization.ZIP"
REMOTE EXECUTABLE STATUS FILE	"MPTERT_Status1.stt"
REMOTE EXECUTABLE PROGRESS DISPLAY FILE	"MPTERT_Status2.stt"
FILE FOR CHECKING TODO LIST	"MPT_TEST_TODO.stt"
OVERALL SYSTEM STATUS FILE	"MPTSystemStatus.stt"
FTP DATA UPLOAD EXECUTABLE NAME:	"MPTERTFTPDataUpload.exe"
FTP STATUS UPLOAD EXECUTABLE NAME:	"MPTERTFTPStatusUpload.exe"

Other files created by the Scheduler:

LOG FILE NAME:	"Field_Mon.log"
(Time listing of file uploads, downloads and jobs run)	
COMMAND FILE NAME:	"MPTERT_command.stt"

(Used by scheduler to communicate with the Remote Executable to stop the system prematurely)

Directories on the web site/ FTP site

FTPSERVER: Default setting is: FTP.SERVER.COM

FTPUSERID: Default setting is: FTPUSER@FTP.SERVER.COM

FTPPASSWORD: Default password is: PASSWORD

FTP INSTRUCTIONS DIRECTORY: Instruct/

FTP DATA DIRECTORY: Data/

FTP STATUS DIRECTORY: Status/

FTP INTERVAL TO CHECK STATUS: This is the interval in seconds at which the system checks the FTP site for instruction files and uploads status files. Typical intervals are from 10 to 300 seconds (5 minutes). Short intervals give a faster response but can create a lot of FTP traffic.

FTP DATA UPLOAD INTERVAL: This is the interval in seconds between data file uploads. Only one file is uploaded at a time so this interval should be shorter than the typical run time for a file otherwise a backlog of files can build up. Typical intervals are 60 to 300 seconds.

FTP MAX STATUS UPLOAD TIME: This is the longest interval in minutes for the Status Uploader to FTP files to the server otherwise the Scheduler restarts the Status Uploader. Typical intervals are 10 to 30 minutes.

Checkboxes on the web site/FTP site

FTP File by Year and Month:

FTP USE FTP:

FTP Zip Data Files:

Appendix A

Sample Files

<u>Configuration File</u>: Contains all of the information from the Configuration form which controls where all files are placed and how often they are updated:

```
UPDATE_RATE:                   5000
MAX_OUTSTAT_REFRESH_TIME:      60
FTPUPDATE_RATE:                3
FTPDATAUPLOADINTERVAL:         300
BATCH_FILE_DIR:                "c:\MPTERTField\Batch\"
SCHEDULE_FILE_DIR:             "c:\MPTERTField\Schedule\"
TOPOLOGY_FILE_DIR:             "c:\MPTERTField\Topology\"
CONFIG_DIR:                    "c:\MPTERTField\System_Config\"
INSTRUCTIONS_DIR:              "c:\MPTERTField\SchedulerInstructions\"
OUTPUT_FILE_DIR:               "c:\MPTERTField\Output\"
STATUS_FILES_DIR:              "c:\MPTERTField\Status\"
TODOLIST_DIR:                  "c:\MPTERTField\ToDo\"
REMOTE_EXECUTABLE_DIR:         "c:\MPTERTField\Remote\"
FTPLOCALDATADIRECTORY:         "c:\MPTERTField\FTP\Data\"
FTPTemp_DIR:                   "c:\MPTERTField\FTP\Temp\"
FTPINSTRUCTIONSDIR:            "Instruct/"
FTPDATASUBDIRECTORY:           "Data/"
FTPSTATUSSUBDIRECTORY:         "Status/"
TODOLIST_FILENAME:             "MPTERT_TODO.lst"
REMOTE_EXECUTABLE_NAME:        "MPTBackground.exe"
REMOTE_WINDOW_NAME:            "MPTBackground"
FTPUPLOAD_EXECUTABLE_NAME:              "MPTERTFTPDataUpload.exe"
FTPSTATUSUPLOAD_EXECUTABLE_NAME:        "MPTERTFTPStatusUpload.exe"
CONFIG_FILENAME:               "MPtFieldMonitor.cfg"
INSTRUCTIONS_FILENAME:         "MPTERT_RemoteInstruction.inst"
BACKGROUND_INSTRUCTIONS_FILENAME:       "MPTERT_BackgroundInstruction.binst"
SYNCHRONIZATION_FILENAME:      "MPTERTSynchronization.ZIP"
OUTSTATMAIN_FILE_NAME:         "MPTERT_Status1.stt"
OUTSTATPROG_FILE_NAME:         "MPTERT_Status2.stt"
COMMAND_FILE_NAME:             "MPTERT_command.stt"
LOG_FILE_NAME:                 "Field_Mon.log"
TEST_TODO_FILENAME:            "MPT_TEST_TODO.stt"
FTPSYSTEMSTATUSFILE:           "MPTSystemStatus.stt"
FTPSERVER:                     "FTP.SERVER.COM"
FTPUSERID:                     "DEFAULTUSER@FTP.SERVER.COM"
FTPPASSWORD:                   "PASSWORD"
```

```
ADDYEARANDMONTH:               "YES"
ZIPAFTERCOLLECTION:            "NO"
USEFTP:                        "NO"
START:
```

Schedule File: Contains the list of electrode arrays for a given data run.

```
16
1    1    1    1    4    1    2    1    3    0    0
2    1    2    1    3    1    1    1    4    0    0
3    1    4    1    1    1    3    1    2    0    0
4    1    3    1    2    1    4    1    1    0    0
5    1    1    1    4    1    3    1    2    0    0
6    1    3    1    2    1    1    1    4    0    0
7    1    4    1    1    1    2    1    3    0    0
8    1    2    1    3    1    4    1    1    0    0
9    2    1    2    4    2    2    2    3    0    0
10   2    2    2    3    2    1    2    4    0    0
11   2    4    2    1    2    3    2    2    0    0
12   2    3    2    2    2    4    2    1    0    0
13   2    1    2    4    2    3    2    2    0    0
14   2    3    2    2    2    1    2    4    0    0
15   2    4    2    1    2    2    2    3    0    0
16   2    2    2    3    2    4    2    1    0    0
```

Column 1 = total number of data points (16) followed by the data point number (1-16)

Columns 2 to 5 = TX Dipoles

       Column 2 = Well #
       Column 3 = Electrode #
       Column 4 = Well #
       Column 5 = Electrode #

Columns 6 to 9 = RX Dipoles

       Column 6 = Well #
       Column 7 = Electrode #
       Column 8 = Well #
       Column 9 = Electrode #

Columns 10 and 11: Zeros

Appendix B

Batch File Structure

Batch file commands consist of a keyword followed by either a text string or a number.   The keyword should be at the beginning of a line and should be written exactly as shown below including being all caps. There can be only one keyword per line.   The order of most of the keywords does not matter. The exceptions are the **IPDATA:** keyword and the **START:** keyword which should be the first and last lines in the batch file.   A list of the keywords and their uses are given below. Note that text fields must start and end with a double quote.

In the discussion below keywords are shown in **red** and example values in **blue**.

IPDATA:
This should be the first line of the batch file.

HEADING: "Header line 1"
This is a text field to be preprinted at the top of the data file.

RESISTANCE: 1
This is the resistance value of the precision resistor used to monitor current flow. It should be 1.0 for standard systems.

MINIMUM_CURRENT: 0.00001
Minimum acceptable current flow. Below this level an error message is generated and the data point is not recorded

CYCLES: 3
This is number of signal averages.   For the MPT system each signal average takes 1.5 waveforms.

DELAY_TIME: 15
Delay time in milliseconds from when the transmitter turns off until the first IP window begins

WINDOWS: 13
Number of windows for IP measurements

INTEGRATION_INDEX: 3

This indicates which of the preset window lengths is used for IP measurements. The window lengths are:

> 1-167 ms
> 2-33.3 ms
> 3-16.7 ms
> 4-5 ms
> 5-2 ms

POST_MEASURE_TIME: **3**

TOPO_FILE: **"C:\MPTERTField\Topology\Sample.TOP"**

SCHEDULE_FILE: **"C:\MPTERTField\Schedule\Sample.SCH"**

CALIBRATION_FILE: **"C:\documents\VB_Programs\CalibrateRx001.MPT"**

OUTPUT_FILE_DIR: **"C:\MPTERTField\Output"**

BATCH_FILE_DIR: **"C:\MPTERTField\Batch\"**

BATCH_FILE_ROOT: **"1HzWenner"**

OUTPUT_FILE_ROOT: **"1HzWenner"**

NEW_GAINS?: **"True"**
Tells the system to start each reading by determining the proper gain levels. The recommended value is true.

UPDATE_GAINS?: **"False"**
Tells the system to overwrite the gain values in the schedule file. The recommended value is false.

FIX_UNDERSCALE?: **"False"**
It instructs the receiver to try to find if preset gain values are dramatically to low and correct them if needed. The recommended value is false

COMM_PORT: **1**
This indicates the comm port connection.

COMM_SETTINGS: **"57600,N,8,1"**

COMM_POLL_DELAY: **1**
This controls how often the system checks the communications buffer to find if data are available. Making this value larger will slow communications. This is generally needed only if the system is having trouble communicating through a USB to serial adapter. Some adapter will lock up if the system polls them too often.

CALIBRATE_UPDATE_INTERVAL: **10000**

SAVE_BY_DATE?: **"True"**
This tells the system to create a new subdirectory win the output folder and store the data files by data.

FAST_TRANSFER?: **"True"**
This allows long record lengths and thus fast transfer of data to the PC.

MEASURE_SELF_POTENTIAL?: **"False"**
Tells the system to add additional time to the run to calculate the system self potential. This option can add a significant amount of time to the data collection run and is not recommened. The recommended value is false.

HIGH_NOISE: **"True"**
In very noisy environments the system may have difficult in picking gain levels. With the high noise option the system uses a lower voltage cutoff thus it tends to pick lower gain levels.   This can actually cause slightly higher error levels so it should be used only when necessary. Generally, this should be used if the system appears to bog down and repeat readings.

CONFIG_DIR: **"c:\MPTERTField\System_Config\MPTFieldmonitor.cfg"**
This is the configuration file used for the autonomous monitoring software only and not needed for normal field operations.

START:

Appendix C

Command File Structure

Section C File Structure

C.1 Overview

As noted in the previous section, the system can run either under internal control using its micro-secure digital card for command and data storage or it can run under the control of an external computer in which case the data are stored on the local computer. In terms of file structures, the primary difference between the different control modes is that **when the system is run under internal control the file conventions below must be rigidly followed** whereas under external PC control we recommend that users follow the structure but there is some flexibility in file names and locations.

Both the data and command files are written using ASCII characters using Microsoft formatting conventions. In this manual, we will indicate specific ASCII character code using a pair of brackets with a decimal number; for example the code for the number "1" is {49}. System commands and data records are written on lines with each line terminated by a carriage return {13} then a line feed{10}. Most files use spaces {32} and/or tab characters {9}.   On the SD card these files are written in FAT32 format that can be read or written by most laptop or desktop computers.

C.2 Schedule Files

*Schedule file*s contain the list of arrays used for each data point in a sequence. They are only used on the personal computer to create *Command Files* which are discussed in the next section.   The naming of schedule files is not critical since they are only used on the PC. However, in the DAS_Acquisition software the default name for the *Command File* is derived from the *Schedule File* name. Therefore it is best to follow the DAS-1 file conventions for filenames: 25 characters including upper case text characters, numbers and the underscore character {95}.

The Schedule File uses the ERTLab structure. Files use standard ASCII characters in Microsoft Windows format. Commands and data fields each occupy a single line of the file with one command or one data field per line. All lines are terminated by a carriage return character and line feed character {13} {10}. Commands consist of a keyword that begins with a "#" {35} character. Most keywords are followed by a deliminator (space, comma or tab) then one or more data values each separated by deliminators.   Any line that begins with a "!" {33} is assumed to be a comment line and the contents of the line are ignored.

In the schedule file the commands/data occur in three blocks: the Translation block, the Electrode Block and the Schedule Block. An example is shown in Figure 4.2.1.

Translation Block

The translation block tells the system how to translate from multiplexer pins to field line-electrode designations. The translation block starts with the keyword: **#trans_start** placed on a line by itself. This is followed by one or more lines each containing 3 integer values which are:

Pin number,   Line Number, Electrode Number

The pin number should be between 1 and number of "pins" in the multiplexer. The standard DAS-1 main unit has 64 pins divided between 4 connectors.   Internally, these pins are numbered sequentially starting with pin 1 on Connector 1 through pin 16 on Connector 1 then continuing with pin 1 on Connector 2 and so on. When additional multiplexers are used, each multiplexer is given and internal address that ranges from 1 to 255 (address zero is always reserved for the main unit).   For multiplexer address 1, the pins are numbered from 65 to 128, for multiplexer address 2 they are numbered from 129 to 192 and so on.

The user may choose to designate all the pins as a single "Line/Well" or split them into multiple Line/Wells each with different numbers of electrodes. There are limits on the line and electrode numbers imposed by the limited space in the system file format. Line and electrode numbers must be greater than zero. Zero is reserved for the remote pole locations for pole-pole or pole-dipole. The maximum size of the line number is 999. For line numbers greater than 99 the maximum electrode number is 99. For line numbers less than 100, the maximum electrode number is 999.

The final line of the translation block must be the keyword: **#trans_end** placed on a line by itself. An example is shown on Figure 4.2.1. Note that unused pins may be left out of the table.

Electrode Block

The electrode block gives the system the location of the electrodes. In data acquisition, its primary use is to allow the system to calculate the geometry factors for calculating apparent resistivities. **If the electrode locations are not correct the apparent resistivities will not be correct.** The electrode block allows the data file to be self-documenting and provides electrode locations for data modeling.

The electrode block begins with the keyword **#elec_start** on a single line. This is followed by one line for each electrode in the translation section above.   The following lines contain two integers followed by at least three floating point numbers and optionally a fourth floating point number and an integer. The integers give the line and electrode designation for electrodes listed in the Translation Block discussed earlier. This is followed by the X, Y, and Z coordinates of the electrode.

Schedule Block

The final section of the schedule file is the schedule block. It contains a list of all of the arrays that the system will measure. The schedule block starts with the keyword: #data_start on a line preceding the first schedule line. The schedule block ends with the keyword #data_end on a line following the last line of the schedule. This should be followed by a blank line or comment. Each line of the schedule file contains nine integer values:

1) The data point number, this value must be present but does not need to be sequential and is not actually used by the program,
2) Line/Well designation for the A (+ Tx) electrode,

3) Electrode Number for the A (+Tx) electrode,
4) Line/Well designation for the B (- Tx) electrode,
5) Electrode Number for the B (-Tx) electrode,
6) Line/Well designation for the M (+ Rx) electrode,
7) Electrode Number for the M (+Rx) electrode,
8) Line/Well designation for the N (- Rx) electrode.
9) Electrode Number for the N (-Rx) electrode, and

All of these numbers must be included on each line. Additional numbers on the line will be ignored by the program. Any Line/Well – Electrode pair must match one declared in the Translation and Electrode blocks.

For efficient field operation it is important that the schedule is sorted by the Tx electrodes. The DAS-Acquisition software looks at successive data point to see if it can allocate multiple receiver channels. For example, the first line of the schedule file is always set as Receiver (Rx) Channel 1. The software then looks to see if the second line of the schedule file uses the same transmitter electrodes. If both lines use the same transmitting electrodes then the second line will be set as Rx Channel 2. This will continue until either all eight channels are allocated or a line is found that has different transmitting electrodes. The software does not reorder the schedule lines and does not exchange the A and B electrodes so the user must provide an ordered schedule file. For ordered files the system will be able to allocate most of its Rx channels most of the time and thus will collect data eight times as fast as a single channel system. For unordered schedules the system will operate essentially as a single channel system. Note that there can be a disadvantage to collecting data with multiple channels. If during data collection the received voltage exceeds 10 volts, on any Rx channel, the DAS-1 will reduce the Tx current to reduce the voltage to an acceptable level on that channel. Unfortunately this can reduce the signal to noise levels on the other channels. This problem occurs only for cases with short electrode separations and a wide range of received voltages. Often this problem can be detected by calculating the Geometric Factors used for apparent resistivity values. Ideally arrays with very small Geometric Factors (~10) should not be collected at the same time as arrays with large Geometric Factors (>1000).

C.3 Command Files

Command files contain all of the information needed to conduct a data run including the system configuration and schedule information. They are created on a personal computer using the DAS-Acquisition software and either executed directly from the PC or downloaded onto the DAS-1 system. Following is an overview of the command files. **Users are strongly discouraged from directly editing the Command Files.** A list of internal commands and more detailed format information is given in Appendix *.

The Command File should follow the DAS-1 filename conventions. The file root should be no more than 25 characters. The characters can include upper case letters, numbers and the underscore character, "_" {95}. The command file must end with a four letter extension CMND.

The Command File is written in ASCII text format. Commands consist of a "#" followed by two or more text characters. The files begin with system configuration information including the Target current and Voltage (see Section 5). This is followed by a listing of the electrode information and finally the multiplexer information that depends on the schedule.

C.4 Data Files

The DAS-1 creates the data file names by appending the date, time and a four letter extension "DATA" onto a file name root parameter in the command file. A typical file name is SANDTANK_20090313_1334.Data. Note that the year is first followed by the month, day then an underscore followed by the time in hours and minutes.

Data files are written directly in ERTLab format. Descriptions of this format are given in the Appendices at the end of the manual.

C.5 Directory Structure

The SD Card REQUIRES five directories to be listed directly in the root (uppermost) directory:

1) **DSTREAM**,
2) **FDIP**,
3) **TDIP**,
4) **SP**, and
5) **SPECTRAL**

Additional directories can be present but are not used or read by the DAS-1. Each of these directories contains two subdirectories:

1) **CMD** and
2) **DATA**.

The **CMD** directory contains the command files created by the PC program and data files are placed directly in the **DATA** directory of the appropriate acquisition type. For example, data from the TDIP acquisition mode will save into the TDIP\DATA\ directory. Note that **only the appropriate command files for a specific Data Mode can be placed in a given subdirectory**. For example, only Data Stream Command Files can be placed in the DSTREAM\CMD\ directory. Trying to make a data run using a TDIP or FDIP command file in the DSTREAM directory will cause a run-time error or erratic results. When the operator opens a command file, the system reads the configuration information which is held in memory then closes the file. When the user then starts a data run, the program looks for the Command file in the correct directory to read the schedule information. If the file is in the wrong directory, the run will terminate with an error. If there happens to be a file of the same name in the correct directory the program will execute using that schedule information; this may lead to unexpected results.

For PC Control Mode it is recommended that the following six directories:

1) **DSTREAM**,
2) **FDIP**,
3) **SCHED,**
4) **TDIP**,
5) **SP,** and
6) **SPECTRAL**

be placed in a convenient folder on the hard drive of the PC, for example, the default MPTERTField directory. The DSTREAM, FDIP, TDIP, SP, and SPECTRAL directories each contain subdirectories named CMD and DATA which contain the Command Files and data respectively. The SCHED directory contains a list of schedule files that can be used to create command files for any of the data modes.