4. FILE STRUCTURE AND FORMAT

4.1 PDAS

To fully utilize the recording flexibility of the PDAS, the file structure and format must be understood. First, the file structure and naming conventions will be documented. Four types of files are created during recording: experiment file, status file, header file, and data file. The format of each type of file created by the PDAS-100 will then be documented.

4.1.1 File Structure and Naming for PDAS-100 RAM-DISK

This is the file structure of the PDAS SMM (RAM-DISK) all files are referenced to drive "C". In the future, with optional recording mediums or techniques the default drive may be different than "C".

C:\	Root directory for PDAS-100.
C:\COMMAND.COM C:\AUTOEXEC.BAT C:\MSKERMIT.EXE C:\MSKERMIT.INI C:\PSLAVE2.EXE C:\PDAS100.BAT C:\PDASINIT.EXE C:\CONFIG.SYS	DOS command file. Autoexec batch file. Kermit program. Kermit initialization program Paranet program. PDAS program batch file. PDAS hardware initialization program. DOS configuration file.
C:\DOS\CHKDSK.COM C:\DOS\ATTRIB.EXE C:\DOS\MODE.COM	Dos subdirectory. Check disk program. Used to set up display file attributes. Used for initializing communication ports.
C:\PDAS\ C:\PDAS\WEXPFILE.EXE C:\PDAS\PDASX.EXE C:\PDAS\PDASNnn.CMD C:\PDAS\DSPFG.LOD C:\PDAS\DSPGR.LOD C:\PDAS\TIMESET.EXE C:\PDAS\COUNTER.HIS C:\PDAS\PDAS\FDASCTTY.EXE C:\PDAS\STnnnRPT.doy	PDAS sub-directory. Write Experiment File Program. Acquisition program. Command file for acquisition program. Fixed gain DSP software. Gain-ranged DSP software. Time set program File for last sequence created history. Serial port initialization program. Status report created during acquisition. nnn - last three digits of PDAS-100 serial number
C:\PDAS\EXnnnFIL.doy C:\PDAS\FInnnLOG.doy C:\PDAS\SHnnnRPT.doy C:\CHj	doy - day of year acquisition begun Experiment definition file created during acquisition List of files created during acquisition. State-of-the-Health file (6 channel PDAS only). Channel j sub-directory. j - O(AUX), 1, 2, 3 (4, 5, 6 for six ch.)

C:\ CHi\ tinnnsss.doy

Recorded data file with this naming convention.

- t C Calibration window (primary)
 - E Event
- P Primary window
- S Secondary window

nnn - last three digits of PDAS-100 serial number

sss - sequence number for record

doy - day of year of start of data

Figure 4-1 on the following page provides an alternate view of the data organization.

In addition to the files identified, status messages may be created in the root directory of the PDAS when the PDAS is operating in the modem configuration. These status message files will have the naming convention of:

STnnnsss.doy nnn - last three digits of PDAS-100 serial number

sss - sequence number for message

doy - day of year for status report

This special situation for modem telemetry is used so that the base station can receive important status messages immediately as opposed to waiting for the status report file to be closed and transmitted at the end of the day.

4.1.2 Command File

The command file is created using PSET.EXE and used by the acquisition programs PDASX.EXE. Its name has the following convention:

PDASOOO.CMD - This is the default command file used by PSET and PDASX if a command file for a particular serial number does not exist.

PDASnnn.CMD - This is the command file used by PSET and PDASX for a target PDAS with a serial number having last three digits nnn.

When the PDAS begins running the acquisition programs WEXPFILE.EXE and PDASX.EXE it will look for the command file which matches its internal serial number. If it cannot find a matching serial number, it will load PDAS000.CMD and begin execution based on that command file. If a PDAS000.CMD file does not exist, an error message will be sent to the setup computer screen.

As new versions of the software which creates the command files (PSET) are written, the old command files may no longer be compatible with the new ones. It is important to remember to delete all old command files when you are provided with a software update. The version of the PSET software which creates the command file must be the same as the version of the PDAS operating software to avoid this problem. If the version of the command file, down-loaded to the PDAS, does not match the version of the PDAS operating software, the PDAS will send a message to the setup computer screen indicating so.

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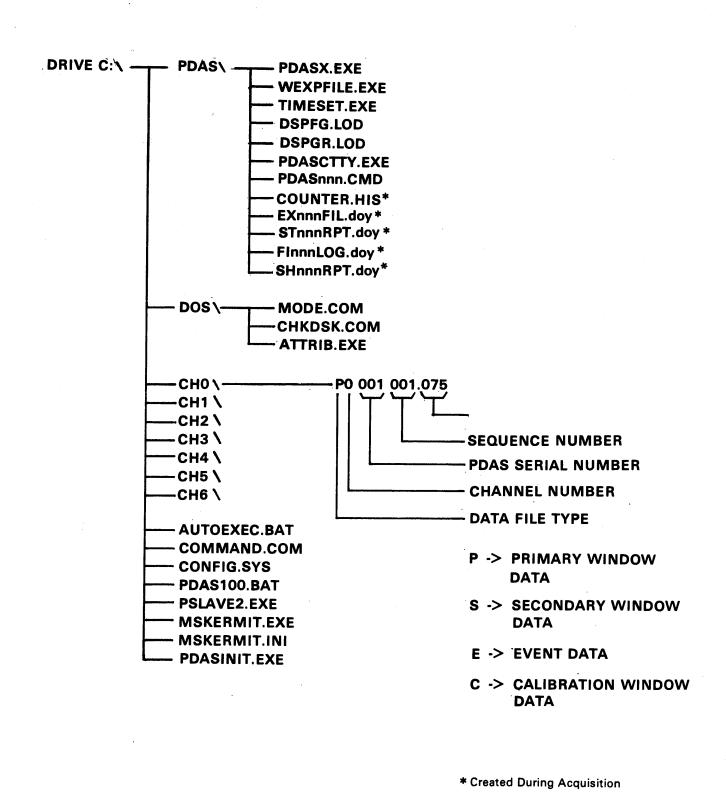


Figure 4.1 PDAS File Structure

4.1.3 Experiment File

The experiment file is a listing of the contents of the command file used to set up the acquisition software. It is written in the PDAS subdirectory of the PDAS-100 RAM Disk. Its name has the following convention:

EXnnnFIL.doy nnn - last three digits of PDAS-100 serial number. doy - day of year acquisition begun.

This file is useful to keep track of the exact specifications of a given experiment. The Experiment File can be used to supplement the field notebook or to determine what may have been set wrong when the expected results were not achieved. This file can be up-loaded with the data files. An example of this text file is given below.

Number Secondary Windows: 2 Number Primary Windows: 8 Number Channels: 7 Serial Number: 19 Clock Type: 1 Drift Compensation: 12000 microseconds per day Jam Set Limit: 10 microseconds Minimum Correction: 10 microseconds Time Constant For Average Time Difference: 1800 seconds Telemetry Mode: 2 Auxiliary Memory Type: 1 Number of ASP Modules: 2 Latitude: 30x50'00.48"N Longitude: 92x40'40.40"W Elevation: 1200 meters Comment: Demonstration experiment configuration file Acquisition Mode: 2 Recording Format Mode: 2 ADC Calibration Interleave Enabled? N Channel O Parameters Enabled? Y Name: AUX Primary Sample Rate: 10.000000 Secondary Sample Rate: 0.000000 Preamp Gain: 1 Low Cut Filter Enabled? N Sensor Sensitivity: Comment: Channel 1 Parameters Enabled? Y Name: CH 1 Primary Sample Rate: 100.000000 Secondary Sample Rate: 5.000000 Preamp Gain: 10 Low Cut Filter Enabled? N Sensor Sensitivity: 629 V/M/S

Channel 2 Parameters Enabled? Y Name: CH 2 Primary Sample Rate: 100.000000 Secondary Sample Rate: 5.000000 Preamp Gain: 10 Low Cut Filter Enabled? N Sensor Sensitivity: 629 V/M/S Comment: SERIAL NUMBER 1123 Channel 3 Parameters Enabled? Y Name: CH 3 Primary Sample Rate: 100.000000 Secondary Sample Rate: 5.000000 Preamp Gain: 10 Low Cut Filter Enabled? N Sensor Sensitivity: 629 V/M/S Comment: SERIAL NUMBER 4552 Channel 4 Parameters Enabled? N Name: CH 4 Primary Sample Rate: 1.000000 Secondary Sample Rate: 0.000000 Preamp Gain: 100 Low Cut Filter Enabled? Y Sensor Sensitivity: Comment: TEMPERATURE Channel 5 Parameters Enabled? N Name: CH 5 Primary Sample Rate: 10.000000 Secondary Sample Rate: 0.000000 Preamp Gain: 100 Low Cut Filter Enabled? Y Sensor Sensitivity: Comment: WIND SPEED Channel 6 Parameters Enabled? N Name: CH 6 Primary Sample Rate: 50.000000 Secondary Sample Rate: 0.000000 Preamp Gain: 1 Low Cut Filter Enabled? Y Sensor Sensitivity: Comment Pre Event Length: 3.000000 seconds Post Event Length: 7.000000 seconds Maximum Event Length: 30.000000 seconds Event Detector Recording Control: S Internal Trigger Mode: 3 CH 1 Enabled? Y CH 2 Enabled? Y

Comment: SERIAL NUMBER 3456

CH 3 Enabled? Y
CH 4 Enabled? N
CH 5 Enabled? N
CH 6 Enabled? N
External Triggers:
Trigger O Enabled? N
Trigger 1 Enabled? N
Trigger 2 Enabled? N
Trigger 3 Enabled? N
Trigger 4 Enabled? N
Trigger 5 Enabled? N
Trigger 6 Enabled? N
Trigger 7 Enabled? Y
Number for Event: 1
Trigger Delta: 1.000000 seconds
STA Time Constant: 1.000000
LTA Time Constant: 30.000000
Bandpass Lower Frequency: 0.500000 Hz
Bandpass Upper Frequency: 5.000000 Hz
Trigger Threshold (ratio): 8.000000
Detrigger Threshold (ratio): 2.000000
Detecting Channel: CH 2
STA Time Constant: 1.000000
LTA Time Constant: 30.000000
Bandpass Lower Frequency: 0.500000 Hz
Bandpass Upper Frequency: 5.000000 Hz
Trigger Threshold (ratio): 8.000000
Detrigger Threshold (ratio): 2.000000
Detecting Channel: CH 3
STA Time Constant: 1.000000
LTA Time Constant: 30.000000
Bandpass Lower Frequency: 0.500000 Hz
Bandpass Upper Frequency: 5.000000 Hz
Trigger Threshold (ratio): 8.000000
Detrigger Threshold (ratio): 2.000000
Primary Window # 1
Enabled? Y
Start Time: 200/1988 00:00:00
Duration: 0:01:00
Number Repetitions: 100
Interval: 1:00:00
Calibration Type: 4
Frequency: 1.000000
Amplitude: 0
CH 1 Enabled? N
CH 2 Enabled? N
CH 3 Enabled? N
CH 4 Enabled? N
CH 5 Enabled? N
CH 6 Enabled? N
Primary Window # 2
Enabled? E

Start Time: 202/1988 00:00:00 Duration: 0:10:00 Number Repetitions: 48 Interval: 1:00:00 Calibration Type: 4 Frequency: 1.000000 Amplitude: 0 CH 1 Enabled? N CH 2 Enabled? N CH 3 Enabled? N CH 4 Enabled? N CH 5 Enabled? N CH 6 Enabled? N Primary Window # 3 Enabled? C Start Time: 204/1988 09:00:00 Duration: 0:00:00 Number Repetitions: 1 Interval: 0:00:00 Calibration Type: 4 Frequency: 1.000000 Amplitude: 0 CH 1 Enabled? N CH 2 Enabled? N CH 3 Enabled? N CH 4 Enabled? N CH 5 Enabled? N CH 6 Enabled? N Primary Window # 4 Enabled? N Start Time: 203/1988 14:00:00 Duration: 0:10:00 Number Repetitions: 50 Interval: 24:00:00 Calibration Type: 4 Frequency: 1.000000 Amplitude: 0 CH 1 Enabled? N CH 2 Enabled? N CH 3 Enabled? N CH 4 Enabled? N CH 5 Enabled? N CH 6 Enabled? N Primary Window # 5 Enabled? E Start Time: 203/1988 00:00:00 Duration: 24:00:00 Number Repetitions: 9999 Interval: 24:00:00 Calibration Type: 4 Frequency: 1.000000 Amplitude: 0

```
CH 1
       Enabled? N
CH 2
       Enabled? N
CH 3
       Enabled? N
CH 4
       Enabled? N
CH 5
       Enabled? N
CH 6
       Enabled? N
Primary Window # 6
Enabled? Y
Start Time: 200/1988 00:30:00
Duration: 0:00:05
Number Repetitions: 9999
Interval: 24:00:00
Calibration Type: 1
Frequency: 0.500000
Amplitude: 1000
       Enabled? Y
CH 1
CH 2
       Enabled? Y
CH 3
       Enabled? Y
CH 4
       Enabled? Y
       Enabled? Y
CH 5
       Enabled? Y
CH 6
Primary Window # 7
Enabled? Y
Start Time: 200/1988 00:30:10
Duration: 0:00:05
Number Repetitions: 9999
Interval: 24:00:00
Calibration Type: 1
Frequency: 1.000000
Amplitude: 1000
CH 1
       Enabled? Y
CH 2
       Enabled? Y
CH 3
       Enabled? Y
CH 4
       Enabled? Y
       Enabled? Y
CH 5
CH 6
       Enabled? Y
Primary Window # 8
Enabled? Y
Start Time: 200/1988 00:30:20
Duration: 0:00:05
Number Repetitions: 9999
Interval: 24:00:00
Calibration Type: 1
Frequency: 5.000000
Amplitude: 1000
CH 1
       Enabled? Y
CH 2
       Enabled? Y
       Enabled? Y
CH 3
CH 4
       Enabled? Y
CH 5
       Enabled? Y
CH 6
       Enabled? Y
```

Secondary Window # 1

Enabled? C

Start Time: 200/1988 00:00:00

Duration: 0:00:00 Number Repetitions: 1 Interval: 0:00:00 Secondary Window # 2

Enabled? N

Start Time: 202/1988 00:00:00

Duration: 0:10:00 Number Repetitions: 25 Interval: 1:00:00

4.1.4 Status Report

The status report lists start times, stop times, possible error conditions which are time stamped, and logs commands which are issued through the PDAS operating screen during the acquisition process. This file operates as an appended file type, it will append operations which occur in a given day unless it has been erased. The file will be closed at midnight and a new file will be started for the next day. Its name has the following convention:

STnnnRPT.doy nnn - last three digits of PDAS-100 serial number doy - day of year acquisition begun

This file is useful to track errors and restarts. When operations which affect internal timing occur, the type of operation and the time it occurred are recorded in this file so that the operator is flagged for possible data quality problems. An example of this text file is given below:

```
PDAS START at 321/1988 16:54:49
ADVANCE ONE SECOND 321/1988 17:07:53
Possible Data Error 321/1988 17:07:55.000 channel 1 Primary Rate
Possible Data Error 321/1988 17:07:55.000 channel 3 Primary Rate
Possible Data Error 321/1988 17:07:55.000 channel 2 Primary Rate
AVERAGE TIME DIFFERENCE CLEARED 321/1988 17:09:41
AVERAGE TIME DIFFERENCE 321/1988 17:09:51 133537 microseconds
ONE PPS ENABLED 321/1988 17:09:58
JAMSET RETARD 321/1988 17:10:18 133537 microseconds
Possible Data Error 321/1988 17:09:55.000 channel 0 Primary Rate
Possible Data Error 321/1988 17:10:20.000 channel 1 Secondary Rate
Possible Data Error 321/1988 17:10:20.000 channel 3 Secondary Rate
Possible Data Error 321/1988 17:10:20.000 channel 2 Secondary Rate
ONE PPS DISABLED 321/1988 17:11:29
AVERAGE TIME DIFFERENCE 321/1988 17:11:32 0 microseconds
PDAS STOP at 321/1988 17:30:37
```

As you can see, these time associated entries are primarily operator induced from the PDAS operating terminal. The exception would be a Jamset which the PDAS would do on its own if the situation warranted it.

4.1.5 File Log

The File Log is the list of files created during acquisition. This file operates as an appended file type, it will append operations which occur in a given day unless it has been erased. The file will be closed at mighnight and a new file will be started for the next day. Its name has the following convention:

FInnnlog.doy.doy nnn - last three digits of PDAS-100 serial number doy - day of year acquisition begun

This file is useful to track all the files created during an experiment and to scan for event files. An example of this text file is given below.

DATASET \ch1\P1019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch3\P3019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch2\P2019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch0\P0019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch1\S1019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch3\S3019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch2\S2019001.200 DATE 7-18-88 TIME 00:00:00.000

DATASET \ch1\C1019002.200 DATE 7-18-88 TIME 00:30:00.000

DATASET \ch3\C3019002.200 DATE 7-18-88 TIME 00:30:00.000

DATASET \ ch2\ C2019002.200 DATE 7-18-88 TIME 00:30:00.000

DATASET \ch1\C1019003.200 DATE 7-18-88 TIME 00:30:10.000

DATASET \ch3\C3019003.200 DATE 7-18-88 TIME 00:30:10.000

DATASET \ch2\C2019003.200 DATE 7-18-88 TIME 00:30:10.000

DATASET \ ch1\C1019004.200 DATE 7-18-88 TIME 00:30:20.000

DATASET \ch3\C3019004.200 DATE 7-18-88 TIME 00:30:20.000

DATASET \ch2\C2019004.200 DATE 7-18-88 TIME 00:30:20.000

EVENT DATE 7-20-88
EVENT TIME 00:09:02.530

DATASET \ ch1\E1019001.202 DATE 7-20-88 TIME 00:08:52.530

DATASET \ch2\E2019001.202 DATE 7-20-88 TIME 00:08:52.530

DATASET \ch3\E3019001.202 DATE 7-20-88 TIME 00:08:52.530

DATASET \ch0\E0019001.202 DATE 7-20-88 TIME 00:08:52.500

Note that when an event tag is created it provides the specific time the event was declared. The event files, however, show that they started prior to the event by a period equal to the pre-event time set during experiment configuration.

4.1.6 State-of-Health Report (six channel only)

The State-of-Health Report lists times and the values in millivolts of chosen measurements. Which values to monitor and the recording interval are defined during PSET. The file name containing this information has the following naming convention:

SHnnnRPT.doy nnn - last three digits of PDAS-100 serial number doy - day of year acuqisition begun

This file is useful to track voltages and temperature of the acquisition system during a recording. The format of this text file is according to the following structure:

(line 1)
Selected Channel ID's 7A 7B 7C ...

(line 2 and following)
Time
Time
Time
...

Channel 7B is connected to the internal +5 volt supply. Channel 7C is connected to the internal -5 volt supply. Channel 7D is connected to the internal +7.5 volt supply. Channel 7E is connected to the internal -7.5 volt supply. Channel 7F is connected to an internal temperature sensor. The recorded voltage for channel 7F is scaled so that 1 millivolt is equal to 1 degree centigrade. Channel 7A, 7G, and 7H are currently unused and are available for the operator to internally connect. Channels 7A through 7E are recorded in millivolts.

This file will continue to update as long as there is room for adding to the file or as long as the PDAS is operating.

An example of the SOH report file is shown below. In this example channels 7A, 7G, and 7H were turned off in the setup procedure and the reporting interval was set to 600 seconds.

		7B	7C	<u>7D</u>	7 <u>E</u>	<u>7F</u>
199/1988	23:55:55	4 9 48	-5115	7581	- 7615	25
200/1988	00:05:55	4958	-5105	7575	-7623	25
200/1988	00:15:55	4943	-5118	7570	- 7610	26
200/1988	00:25:55	4955	-5110	75 9 0	-7622	26
200/1988	00:35:55	4945	-5108	7583	- 7618	26
200/1988	00:45:55	4948	-5120	7565	-7616	25
200/1988	00:55:55	4960	-5115	7584	- 7630	25

4.1.7 Data File

The data file has two parts, a record header and the collected data for a channel. These files are written to sub-directories on the PDAS-100 static

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RAM disk during acquisition. Each channel being recorded has its own subdirectory, \CHO, \CHI, There are four types of files which can be recorded for a channel, each with its own letter designating type:

j - channel number

nnn - last three digits of PDAS-100 serial number

sss - sequence number

doy - day of year of start of file

NOTE

The sequence number for Primary windows and for Calibration windows use the same counting sequence. That is to say if the first recording of the day was a primary window, it would have sequence number 001. If the second and third recordings for that day were calibrations they would be sequence numbers 002 and 003. If the next recording was a primary window it would have sequence number 004.

4.1.7.1 Data File Header

The first part of the data file is a text listing defining the contents of the file. In particular, this text is in DADiSP import format. An example data file header follows.

DATASET P1001001134
FILE_TYPE LONG
VERSION next
SIGNAL channel 1
DATE 5-13-88
TIME 17:59:00.00 (000)
INTERVAL 0.010
VERT_UNITS Counts
HORZ_UNITS Sec
COMMENT None
DATA

Definitions for each of the lines in the data file header follow:

DATASET

The data set is the DOS file name assigned to the data file during acquisition. Note that the file extension has been moved to the left of the decimal point.

FILE TYPE

The file type defines the method by which the data was recorded and is stored in the DOS file.

INTEGER => 16-bit (2 byte) FG data samples
LONG => 32-bit (4 byte) data samples
LONG => 14/2 (2 byte) GR data samples
(see COMMENT also)

VERSION

The "next" parameter in this field causes DADiSP to find the highest existing version of the Dataset Name and sets the new version to the next higher value.

SIGNAL

This field contains the name given to the channel when the ASP screen was defined during the experiment configuration file creation.

DATE

This field contains the date that the data file was recorded.

TIME

This field contains the time for the first sample in the data file. It is recorded in 24 hour format with millisecond resolution. The PDAS starts each recording block at the 10 millisecond mark. For event files, 1 to 9 milliseconds are added to the pre-event length to place the start of the data set on a 10 millisecond mark.

INTERVAL

This field will reflect the chosen sample rate for the data channel. It is provided as sample interval with the units of seconds.

VERT UNITS

The vertical units for the data will always be counts.

HORZ UNITS

The horizontal units for the data will always be sec. (The abbreviation for seconds).

COMMENT

The information in this field will vary depending on how the data was recorded within the PDAS. The following information describes what will be in the COMMENT field based on what recording mode was selected.

COMMENT	DATA FILE TYPE
NONE	16 bit (2 byte) FG data samples (INTEGER) 32 bit (4 byte) FG data samples (LONG)
GAINRANGED	14/2 (2 byte) GR data samples 14/2 (LONG)
DEGAINRANGED	32 BIT (4 byte) FG data samples (LONG) which were acquired as 14/2 GR samples and degain-ranged using the DRANGE program.

NOTE

The data file header is variable in length. The actual channel data is preceded by the following string:

DATA<CR><LF>

A suggested method for searching for the channel data is to perform a string search for the word DATA, then skip two bytes. The balance of the channel data file is data in one of the formats described in the following section.

4.1.7.2 Data File Data

The second part of the data file is the digitized data collected for the channel. This is stored in binary according to three formats.

Two byte integer Four byte integer Two byte gain range

In all cases the bytes are organized in "INTEL" format. INTEL format for 16 bit data words (as well as 32 bit LONGS) assumes that the most significant byte is at the highest memory location. Bits within the byte follow the convention of most significant bit being the left-most bit and least significant bit being the right-most.

Use of the two byte recording formats increases the length of data which may be recorded on the PDAS-100, while use of the four byte integer format provides the most resolution.

16-BIT DATA FORMAT

The two byte integer is stored in two's complement format. To convert this count to voltage, use the following formula:

Let m be the digitized value in counts. Let p be the preamp gain. Let v be volts.

Then: v = m / (32768 * p)high gain inputs v = 20 * m / (32768 * p)low gain inputs

32-BIT DATA FORMAT

The four byte integer is also stored in two's complement format. To convert this count to voltage, use the following formula:

> Let m be the digitized value in counts. Let v be volts.

Then: v = m / 2147483648high gain inputs v = 20 * m / 2147483648low gain inputs

14/2 GAIN RANGED FORMAT

The two byte gain ranged format uses a 14/2 gain range. The gain code is stored in the two least significant bits of the 16 bits, and the digitized value is in the upper 14 bits of the 16 bits.

Let g be the gain code from the lower two bits.

Let p be the preamp gain.

Let m be the value (two's complement) in upper 14.

Let v be volts.

Then: v = m * (8**(5-g)) / (268435456 * P)high gain inputs v = 20 * (m * (8**(5-g))) / (268435456 * P) low gain inputs

The digitized samples are stored packed in the rest of the data file until the end of file is reached.

4.2 SETUP COMPUTER

4.2.1 File Structure and Naming Conventions

All data files exist within the framework of the MS-DOS file and directory conventions. The command files are built in the PDAS sub-directory on the setup computer.

ROOT directory for drive c (any drive) c:\

Other sub-directories

PDAS-100 setup sub-directory c:\PDAS\

c: \PDAS\PSET.EXE Command file build program. c:\PDAS\ *.SCN User input screen definition.

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c:\PDAS\ *.BAT Batch files c:\PDAS\PDASnnn.CMD nnn - Last three digits of target PDAS-100 serial number. Use 000 to build file that will run on any PDAS-100. c:\KERM230\ Kermit sub-directory. Kermit is a public domain computer to computer communications software program which can enable a computer to act as a terminal or a basic file server. c:\PARANET\ Paranet sub-directory. Paranet is a program that allows transfer of data between two microcomputers. c:\DSP\ DADiSP sub-directory. DADiSP is a digital data analysis and signal processing software package. c:\XTALK4\ Crosstalk MK4 sub-directory. Programs for modem base station operation. Only on systems with c:\PDASnnn\ Suggested sub-directory naming convention for locating data and status files from PDAS units. c: \PDASnnn\chj\ Suggested sub-directory naming convention for locating PDAS data. c:\PDASnnn\PDAS\ Suggested sub-directory naming convention for PDAS non-data files (status report, experiment file, etc.).

Help files for fields within screens

Output command files.

c:\PDAS\

c:\PDAS\

*.HLP

*.CMD