APOGEE LABS

AL529

PILOT CONTROL UNIT

USER MANUAL

WARRANTY

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APPENDICES

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CHAPTER 1 : INTRODUCTION

1.1 OVERVIEW

This document defines the function and operation of the Apogee Labs AL529 display, which is utilized as the Pilot Control Unit (PCU) within the Airborne Data Acquisition System (ADAS). Information regarding the various user interface screens as well as the Ethernet communications between the panel and other ADAS devices are described in this document. The electrical interface, mechanical dimensions, and environmental operating conditions are also defined in this document. The AL529 display consists of custom software running on a Panasonic FZ-G1 Toughpad.

2. : SPECIFICATIONS

The full specifications for the Panasonic Toughpad ® FZ-G1 tablet can be obtained from Panasonic at this link: ftp://ftp.panasonic.com/computer/fzg1/

2.1 MECHANICAL & ENVIRONMENTAL
- DIMENSIONS - 10.6"(L) x 7.4"(W) x 0.8"(H)
- WEIGHT - 2.4 lbs
- MIL-STD-810G certified (4' drop, shock, vibration, rain, dust, sand, altitude, freeze/thaw, high/low temperature, temperature shock, humidity, explosive atmosphere)
- IP65 certified sealed all-weather design

2.2 DISPLAY CHARACTERISTICS
- Resolution: WUXGA 1920(horizontal) x 1200(vertical) pixels (Viewed in Landscape orientation)
- Screen Size: 10.1" daylight-readable screen with anti-reflective and anti-glare screen treatments
- Touchscreen: 10-point capacitive multi touch + digitizer screen
- Supports bare-hand touch and gestures and electronic waterproof stylus pen
- Supports glove mode and wet-touch mode
- Brightness: 2-800 nit IPS display with direct bonding
- Backlight: Rugged LED-based backlight

2.3 SOFTWARE
- Operating system: Linux

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3. : PILOT CONTROL UNIT DISPLAY PAGES

This section describes the user interface pages that will be presented to the operator.   The following figure provides a tree showing the page hierarchy.
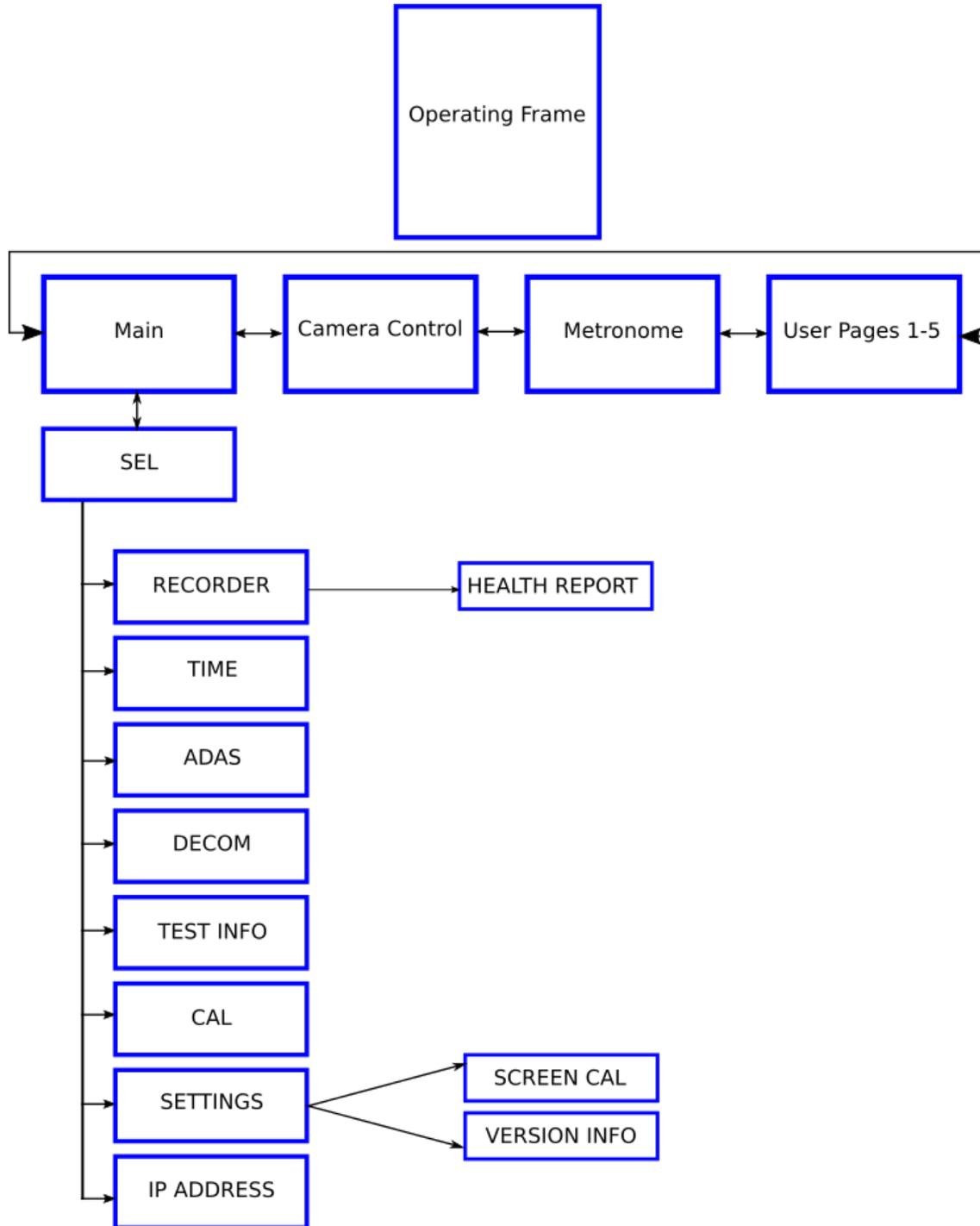
Figure 1: Operator's Panel Screen Tree

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3.1   OPERATING FRAME

The following figure shows the operating frame that will contain all pilot display pages during normal flight operations mode.
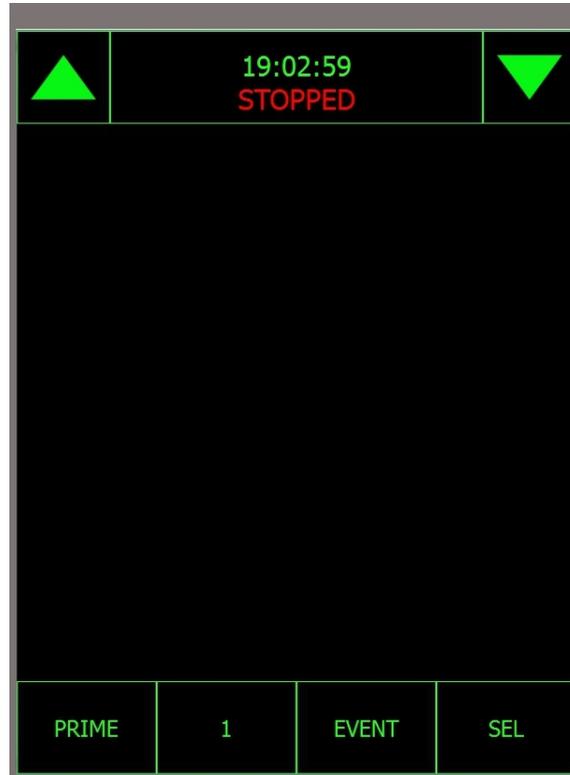
Figure 2: Operating Frame

3.1.1   Arrow Keys

At the top left and right of the Operations Frame are up and down arrows, which allow the operator to move up and down through the different pages. The keys navigate from the Main Flight Page to optional pages such as a Metronome Page, Gauge Pages, Camera Control Page, or custom user pages. The displayed page will toggle with a momentary press of the arrow buttons.

3.1.2   Time

The time is displayed in the top center of the operating frame. If the *time mode* is set to the legacy value of **recorder time**, it will operate like this:

    The operating frame will display the recorder time in GREEN if the recorder time is available. If the recorder time is not available, the system time will be displayed there in RED.

If the *time mode* is set to **PTP time**, it will operate like this:

If we have a valid PTP time lock, we will display the system time in GREEN text in the top center of the operating frame. Otherwise, the system time will be displayed there in RED.

3.1.3   Recorder State
The Recorder State is displayed up top, directly underneath the time.

3.1.3.1 Normal States

If the recorder is running without error Recording shall be displayed in green. If the recorder state is stopped the recording text will change to Stopped and be displayed in red.

3.1.3.2 Abnormal States

The following states should result in a red indication on the PCU and have the associated text. Note the display of the stopped state message takes precedence over the NEOM condition.

State	Display
No response to recorder commands or no status received	**NO RESPONSE**
Recorder status indicates critical error	**REC FAIL**
Recorder less than 1 hour memory remaining	**NEOM XX MIN**
Recorder out of memory	**MEM FULL**

Table 1: Abnormal States

3.1.4   Prime Data Button

Prime Data is used to indicate a portion of the flight where the data should be processed to evaluate a given item on the flight card. Pressing the Prime Data button toggles the state of the Prime Data Bit of the recording parameter. The PCU should display Prime Data as black text on a green background when in prime data and green text on black background when prime data is off. Figure 2 shows the prime data off state.

There should be two state changes when Prime Data is turned off. First the prime data bit should be set to low then between 0.1 and 0.2 seconds later the event number should be incremented by one. The broadcast message and NETDAS register update messages should be sent immediately, that is not waiting for the normal one second update interval.

The Prime Data button utilizes the delay setting value to prevent the button from being accidentally pressed too many times in a row. After pressing the Prime Data button once, it waits until the delay value time (in milliseconds) has expired, before accepting another button press.

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3.1.5 Event

The Event button allows the operator to increment the event counter without leaving prime data mode. When the Event button is pressed it should momentarily turn to a green background to provide feedback that the button was pressed. The number box next to the event counter is the current event number. Pressing and holding the button for 2 seconds will pop up a keypad allowing the operator to reset the value to 1 or some other desired value. The event parameter is a 16 bit unsigned integer. If the event count reaches 65553 the next event change will roll the number to 1.

3.1.6 SEL Button

The Select button must be pressed and held for a user defined delay interval before it is activated. When activated the Select button takes the user to a page allowing selection of a number of system functions detailed in later sections of this specification.

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3.2   MAIN FLIGHT PAGE

Figure 3 shows the Main Flight Page. This page should be displayed whenever power is cycled to the PCU. This page displays the current aircraft, flight, event number and current calibration state of the system. Cal modes other than OFF should be displayed as red on this page
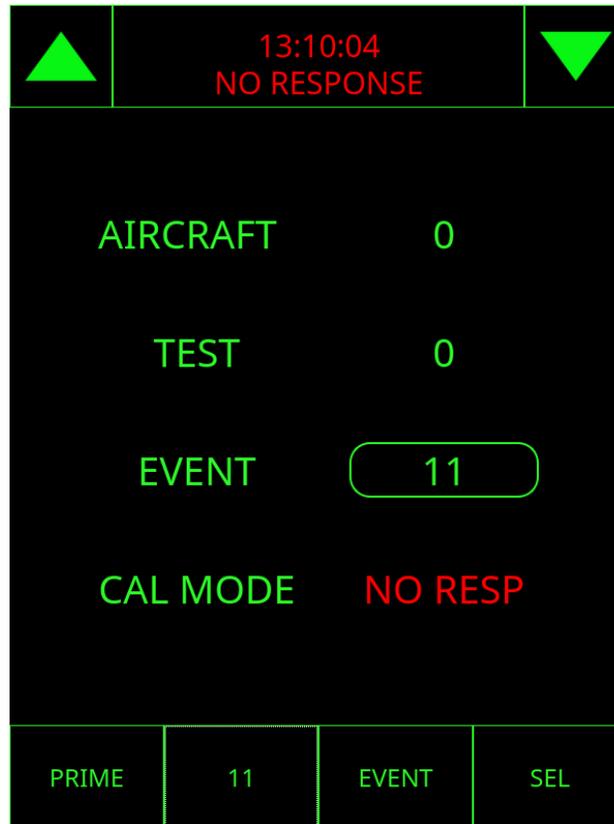
Figure 3: Main Page Normal Operation

3.2.1   Event Parameter Changes

Pressing and holding the value field next to the EVENT label in the middle of the screen will pop up a keypad allowing the operator to change the event value. The length of time required to bring up the keypad is user definable by changing the DELAY parameter in the settings menu.

3.2.2   Data System Warnings

The Cal Mode button will be replaced with a red warning message saying **NO RESP** if the status broadcast is not detected from the data acquisition system for 10 seconds.

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3.3 METRONOME PAGE

The metronome page is used during flying qualities evaluations where visual and audio cues are required to guide pilot stimulus to a control input device.

Figure 4: Metronome Page

The preceding figure shown the metronome page. When activated, the indicator will move from side to side indicating the desired stick position to the pilot. The PCUs audio output is also used as a cue which is useful at higher input rates when the visual cue is difficult to follow.

3.3.1 Start / Stop Button

When the start button is pressed, the PCU will play an audio file counting down the start of the sweep from 5 seconds to start. After the audio file completes, the indicator will move and follow the position given in the selected sweep file. While the sweep is in progress the Start Button will switch text to display Stop. If the Stop Button is pressed the sweep will be terminated immediately. While the file is running the PCU will beep each time the ball changes direction.

When the file is finished the screen will display the message sweep complete and a sweep complete audio message is played.

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3.3.2 Sweep Select Button

The button to the right of the start button is used to select the sweep profile for the test. When the button is pressed a popup showing sweep file names will be shown. When the user selects a particular sweep the name is displayed on the button. The name shall be truncated if it exceeds 10 characters. If there is an error with the selected sweep file, an error message will be displayed above the start button area, and the start button itself will be greyed out to prevent its activation.

3.3.3 Support Files

The PCU shall contain a **Metronome** directory in the FTP's **pub** folder, which is used for loading the required support files. In this directory there are two subdirectories named **Sound** and **Sweep**. In the **Sound** subdirectory are three audio files (only .wav files are supported). One file will be named *start_message.wav*, another one will be named *stop_message.wav* and the final file is named *beep.wav*. In the Sweep subdirectory is where the instrumentation group will load the desired sweep files, prior to flight.

The sweep file will be a text file with the following form.

Line	Data Element
1	Comment Line, usually filename (Actual file names are visible on sweep selection button)
2	Rate that data is updated in updates per second (Typically 20)
3	N the Number of data values in the file
4	Value 1
5	Value 2
	Note: Values must be in the range from -1.0 to + 1.0.
N+3	Value N

Table 2: Sweep File Definition

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3.4 CAMERA CONTROL PAGE

The Camera Control Page is used to control and monitor IDT high speed cameras attached to the same network as the PCU. This number of cameras, camera groups and the position of each, is defined using the **INI.txt** file.

3.4.1 Camera Setup

To enable the camera control page, you must configure the PCU's *INI.txt* file by adding this line:

```
camera=on
```

You can add up to six cameras and six trigger groups to the INI file. A trigger group is a button which triggers a configured collection of cameras. The trigger group button will not be enabled unless all associated cameras are ready.

Each camera needs to have its IP address specified, the objects X,Y coordinates for the page, and label text to display. Here is how these values are entered for each camera. *N* is the camera number (1 through 6)

To assign the camera's IP address, use:

```
cameraN=aaa.bbb.ccc.ddd
```

To assign the camera's X,Y position, use:

```
cameraNxy=X,Y
```

To assign the camera's label text, use:

```
cameraNlabel=label_text
```

Here is how these values are entered for each group. *N* is the group number (1 through 6)

To assign the group's label, use:

```
groupN=group_name
```

To assign the group's X,Y position, use:

```
groupNxy=X,Y
```

To assign which cameras are in the group, use: (Add the included camera numbers with comma separators.)

```
groupNcameras=cam_num1<,cam_num2,cam_num3,cam_num4,cam_num5,cam_num6>
```

The camera page area has a dimension of 900 x 1140 pixels.
Each camera object has a size of 200 x 237 pixels.
Each group object has a size of 200 x 147 pixels.
To align a group object vertically with a camera object, add 60 to the group's y coordinate.

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3.4.2 Camera State

The camera icons displayed on the screen will show green if the camera is present with Irig time lock and memory remains. The camera icon will show red if the camera is not present, Irig lock is missing or memory is empty. A group camera icon will be green if the associated cameras are green, or grey if either camera is red.

3.4.3 Camera Control

Pressing a camera icon will trigger only the camera selected. Pressing a camera group button will cause all associated cameras to capture a buffer.

3.4.4 Camera Status Message

Above each camera icon is a text description of the camera state is displayed. Error messages are displayed in the following order of severity: camera NOT PRESENT, END OF MEMORY and NO IRIG. If no errors are present the camera icon will display READY if waiting for a trigger, and TRIGGERED if a capture is in progress.

3.4.5 Memory Remaining

Below each of the camera icons is a textual indication of the number of buffers still available for each camera.

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3.5   SELECT PAGE

The Select Page is used to navigate to pages not typically used during flight. The page is reached by pressing and holding the SEL button on the bottom right hand corner of the main page. There is a delay timer in the settings menu, which sets how long you need to hold the SEL button before entering the SELECT PAGE.
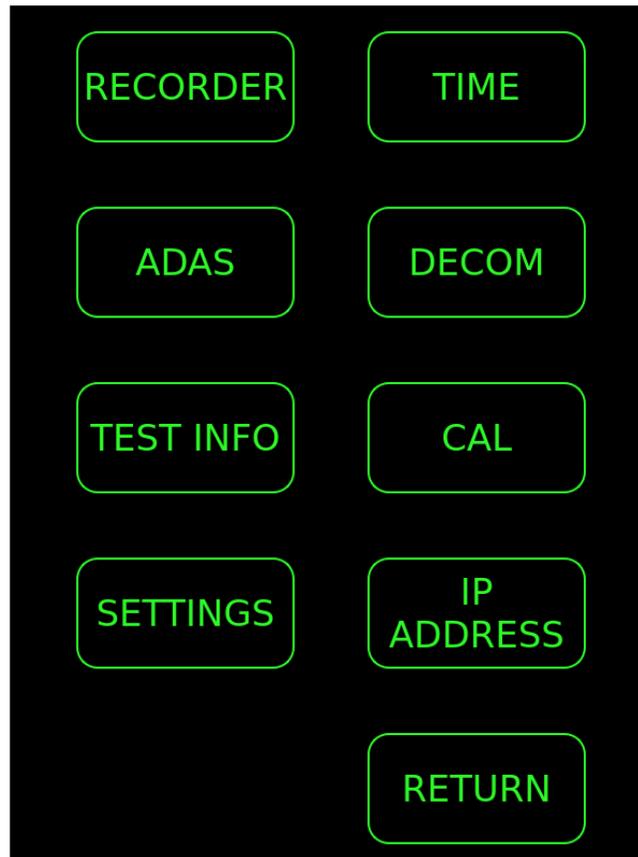
Figure 5: Select Page

3.6   RECORDER PAGE

The recorder page will display the current recorder state, the memory remaining and the recorder health status.
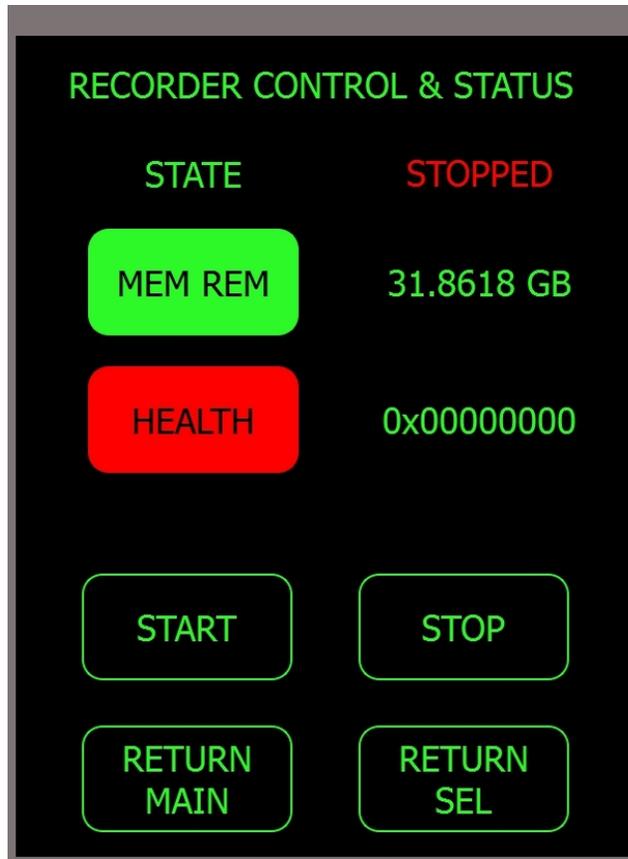
Figure 6: Recorder Page

The recorder state is normally RECORD or IDLE but it can take on the values shown in the following table which contains data from **Figure 6-18** in the *IRIG 106 Chapter 6* specifications. The table shows how to decode the state code into human readable form. On the PCU display, STOPPED will be displayed instead of the word IDLE.

IRIG 106 CH 6 TABLE 6-18. RECORDER STATES		
State Code	**State Name**	**Progress Description**
00	FAIL	---
01	IDLE	---
02	BIT	Percent complete
03	ERASE	Percent complete
04	DECLASSIFY	Percent complete
05	RECORD	Percent media recorded
06	PLAY	Percent recording played
07	RECORD & PLAY	Percent media recorded
08	FIND	Percent complete
09	BUSY	---
10	ERROR	---

Table 3: CH10 Recorder States

3.6.1 Mem Remaining Button

Pressing the Memory Remaining button will toggle the display between the number of remaining minutes estimated and the amount of memory left in Giga-Bytes. Memory Remaining should display NEAR OM with less than 60 minutes left and MEMORY FULL when no memory remains. The button will have a green background unless the NEOM or MEMORY FULL condition exists.

3.6.2   Health Button

The health button is colored green if the top level status does not indicate any failures. It will be colored yellow if only non-critical errors are present, and it will be colored red if critical errors are present. Pressing the health button on the recorder page will list the details of the *.health* command for the included interfaces. Pressing a particular health item will display the detailed health for the channel using the *.health N* command. Where *N* is the channel number.

3.6.3 Start and Stop Buttons

The recorder page has start and stop buttons to control the recorder operation.

3.7   TIME PAGE

3.7.1   IRIG Time Mode

There are two modes of operation for the time page. The first mode is the legacy IRIG based configuration, selected via the INI file using **timemode=RECORDER** or with no **timemode** entry at all. In this mode the time page will display the system time of the PCU, the current recorder time and the data acquisition system time. The recorder time and data acquisition time should match as the recorders IRIG output is used to supply time to the data acquisition hardware. If these times are more than one second apart, an error message will be listed under the ADAS time, if it is not locked to the recorder output IRIG signal (see the figure below).

The time page will allow the user to set the time on the recorder in the absence of GPS or external IRIG signals. Pressing the displayed recorder time button will activate the entry window which allows the user to enter the IRIG day, hours, minutes and seconds. The user can also set the system time on the PCU in a similar fashion.

In this legacy IRIG mode there are two buttons which allow the user to set the time of the PCU from the recorder, or set the time of the recorder from the PCU.
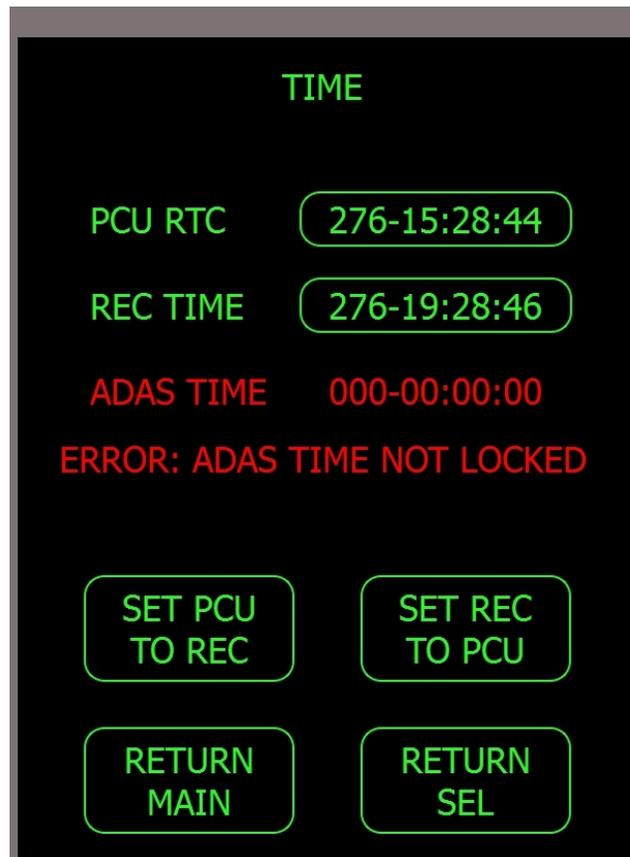
Figure 7: Time Page in Legacy IRIG Mode

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3.7.1.1 Set PCU to REC button

This button sets the PCU's system time to be the same as the current time on the recorder.

3.7.1.2 Set REC to PCU button

This button sets the recorder's system time to be the same as the current time on the PCU.

3.7.2 PTP Time Mode

The second operational mode for the time page is the PTP time mode, used when the all pieces of that system are utilizing PTP to synchronize time, instead of IRIG. On the PCU, this mode is selected via the INI file using **timemode=PTP**. Additionally, there is a INI parameter named **ptpserver** which must be set to the IP address of the OnTime network switch that is acting as the PTP server.

In the PTP time mode the time page will display the system time of the PCU, the current recorder time, the data acquisition system time, and an additional field for the PTP Time. There will not be SET PCU TO REC or SET REC TO PCU buttons displayed when in PTP time mode.

Figure 8: Time Page in PTP Mode

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If we have a valid PTP lock, the PCU RTC label, PTP TIME label and both associated time display fields will turn green, and the PCU RTC time will be displayed in the PTP TIME field.

If we do not have a valid PTP lock, the PCU RTC label, PTP TIME label and both associated time display fields will turn red. Additionally, the PTP TIME field will show dashes, instead of the PCU RTC time. Below the PTP TIME field, there will be a description of the current PTP status in red text ("PTP ERROR", "PTP WARNING" or "PTP SEARCH").

The recorder time and data acquisition time should match as all equipment should be getting their time from the PTP server. If the times are more than one second apart, an error message will be listed towards the bottom of the page.   If the PCU does not receive the time from the recorder, the record fields will be red. If the PCU does not receive the ADAS broadcast stream, the ADAS fields will be red.

Pressing the PCU RTU button will permit the user to manually enter the PCU time. Pressing the REC TIME button will permit the user to manually enter the recorder time, which will be sent to the recorder. Pressing the PTP TIME button will permit the user to manually enter the PTP TIME, which will then be sent to the OnTime network switch, at the IP address listed as the INI file's **ptpserver** value.

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3.8 ADAS PAGE

Pressing the ADAS button will take the user to a page which displays the data system broadcast status for the PCM lock and the incrementing counter from the status broadcast.

3.8.1 No Active ADAS Broadcast

If there is not an active ADAS broadcast occurring, this screen will show red entries for FRAME SEARCH and SUB FRAME SEARCH, as shown in the following figure.
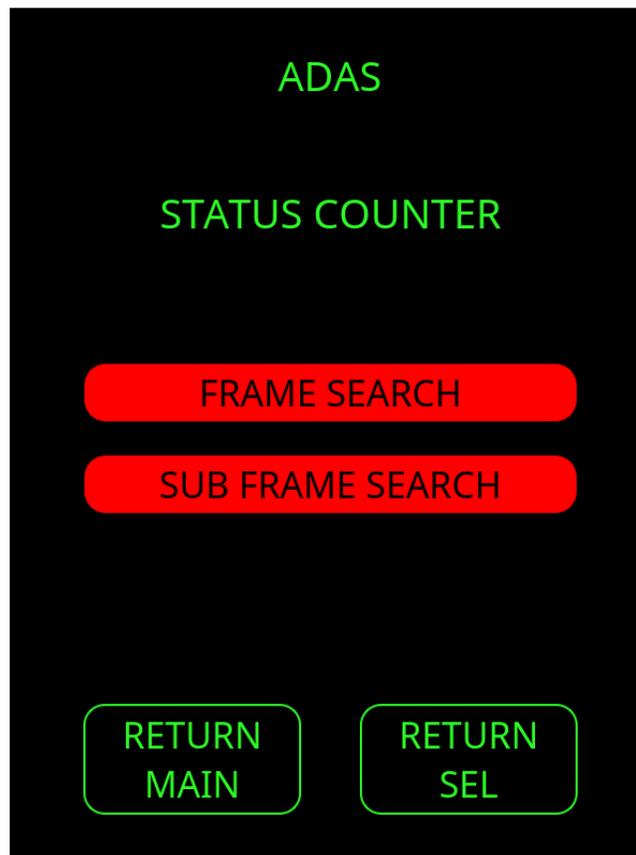
Figure 9: ADAS Page – Red Search

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3.8.2   Active ADAS Broadcast

When there is an active ADAS broadcast occurring, the two entries will turn green and the words which say SEARCH will change to either FLYWHEEL, LOCK, SEARCH or CHECK.
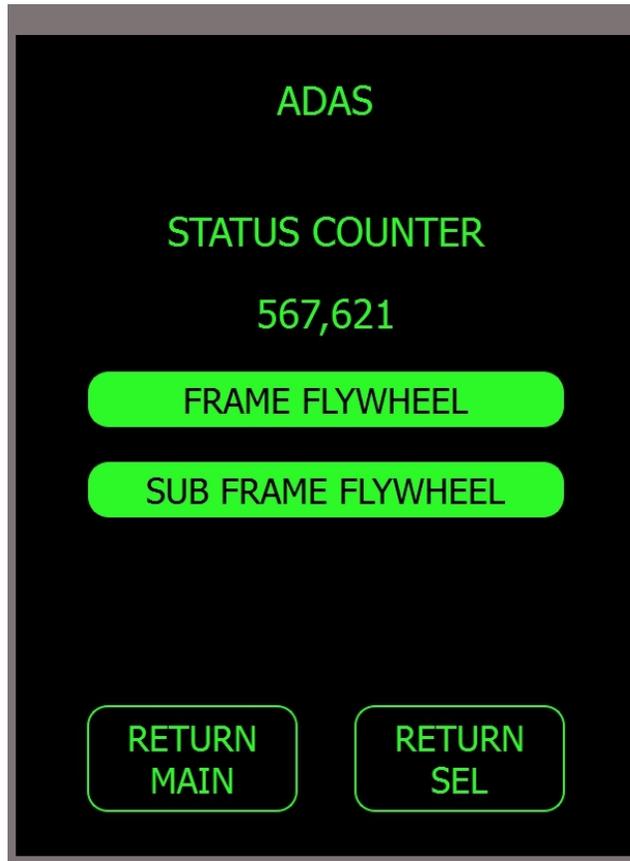
Figure 10: ADAS Page - Valid

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3.9 DECOM PAGE

The Decom Page will allow access to the Packetized PCM steam provided by the data acquisition system, via the ADAP IP Address and Port Number. The page will allow the user to select from preloaded parameters from the TMATS file, or to enter in the word and frame values directly from the panel. The values will be displayed numerically in a user selected format and also on the half-circular gauge as shown below.
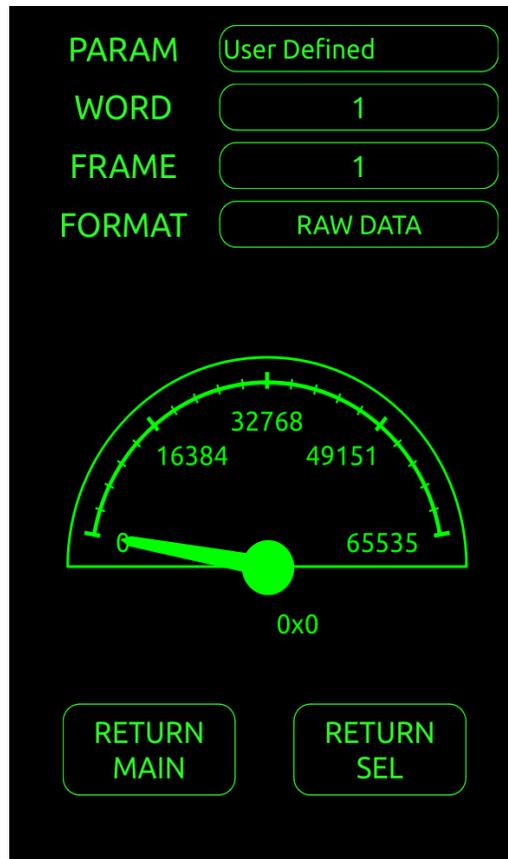
Figure 11: Decom Page

3.9.1 Parameter Button

When the user presses the parameter button a list of measurements contained in the parameter file will be displayed from the active TMATS file. The list will be in alphabetical / numerical order and a scroll bar will be provided if the list exceeds the screen length. The word and frame associated with the first occurrence of the parameter will be displayed. To manually enter a word and frame location, the user must select "User Defined" from the drop down list. (The parameters are alphabetized, however "User Defined" will always be the first entry in the list.) If you do not have only one TMATS file in your pub/TMATS directory, there will be an error displayed in for the PARAM button text.

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3.9.2 Word and Frame Buttons

The user may select a word and frame to display by pressing these buttons. A keypad will appear when the button is pressed to allow user entry. These buttons are only active when the current parameter is "User Defined", otherwise they display the values associated with the currently selected parameter.

3.9.3 Format Button

The format button shows the current display format associated with the selected parameter. When in user defined parameter mode, the format is always "RAW DATA", showing the raw hexadecimal value of your selected word / frame combination.

3.9.4 Gauge Display

A half-circular gauge and associated numeric display are provided at the bottom of the DECOM PAGE, which helps to visualize the data.

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3.10   CALIBRATION PAGE

The CALBRATION PAGE allows the user to put the system in one of three Cal states or into the Auto Cal sequence. The current calibration state should be displayed on a green background. If there is no response from the remote hose, NO RESP will be displayed in red text, next to the CURRENT STATE label. A Cal command should time out in one minute if not removed by the user. The current state should cycle when the Auto Cal state changes, as reported by the master unit, and both the auto cal and the cal state will be shown as black text with a green background.

```
              CALIBRATION PAGE
          CURRENT STATE: OFF


          ┌─────────┐   ┌─────────┐
          │  ZCAL   │   │  NCAL   │
          └─────────┘   └─────────┘

          ┌─────────┐   ┌─────────┐
          │  XCAL   │   │  AUTO   │
          └─────────┘   └─────────┘

                        ┌─────────┐
                        │   OFF   │
                        └─────────┘

          ┌─────────┐   ┌─────────┐
          │ RETURN  │   │ RETURN  │
          │  MAIN   │   │   SEL   │
          └─────────┘   └─────────┘
```

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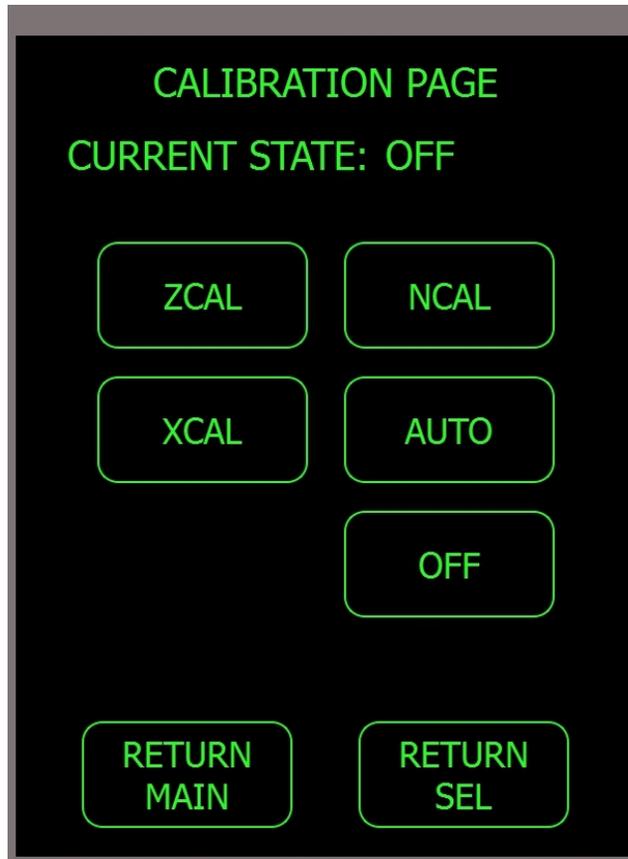
3.11   TEST INFO PAGE

The TEST INFO page allows the user to update the Aircraft number, the Test number and the Event number. It appears similar to the main flight page, but lets you set all of the variables with normal momentary button presses. When the user selects a parameter to change, the keypad will appear, allowing the user to enter the desired value. After entering a valid value, the keypad will close and PCU will send the updated parameter value to the ADAS via a broadcast message.
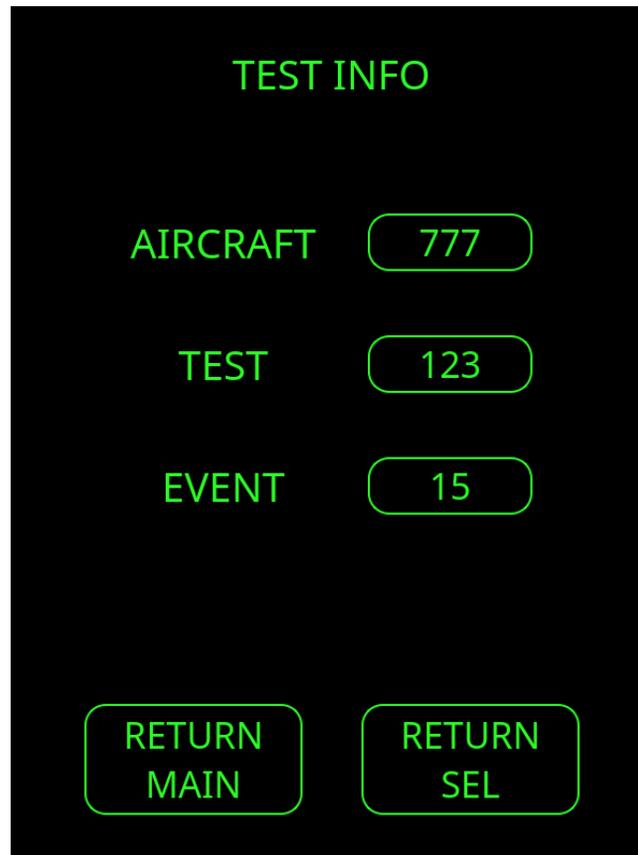
Figure 12: Test Info Page without ODPs

Also on this TEST INFO page, is where Operator Defined Parameters (ODPs) will appear. Up to ten of these ODPs can be defined, and those parameters will placed on this screen below the EVENT parameter.

The ODPs are defined in a file named ODP.txt which is located in the ftp's pub directory where the system's INI.txt file is located. This file is explained in the appendix.

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Here is an example of what the TEST INFO page looks like with all ten possible Operator Defined Parameters enabled in the ODP.txt file.

Figure 13: Test Info Page with ten ODPs

When the user clicks the value button on one of the ODP parameters, a keypad will appear, letting the user modify the value. Because these values are floating point numbers, the keypad has a decimal place and a negative sign.

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3.12 IP ADDRESS PAGE

The IP address page will allow the user to view the IP address of the PCU, Recorder, Master DAU and Broadcast address for the PCU status packet and the ADAS broadcast. Pressing the IP address next to the given device will allow the user to change the IP address and subnet mask and port where needed.

IP ADDRESSES

PCU	166.20.234.20
APOGEE BROADCAST	235.0.0.5
RECORDER	166.20.234.100
ADAS	166.20.234.20
ADAS BROADCAST	235.0.0.10

RETURN MAIN   RETURN SEL
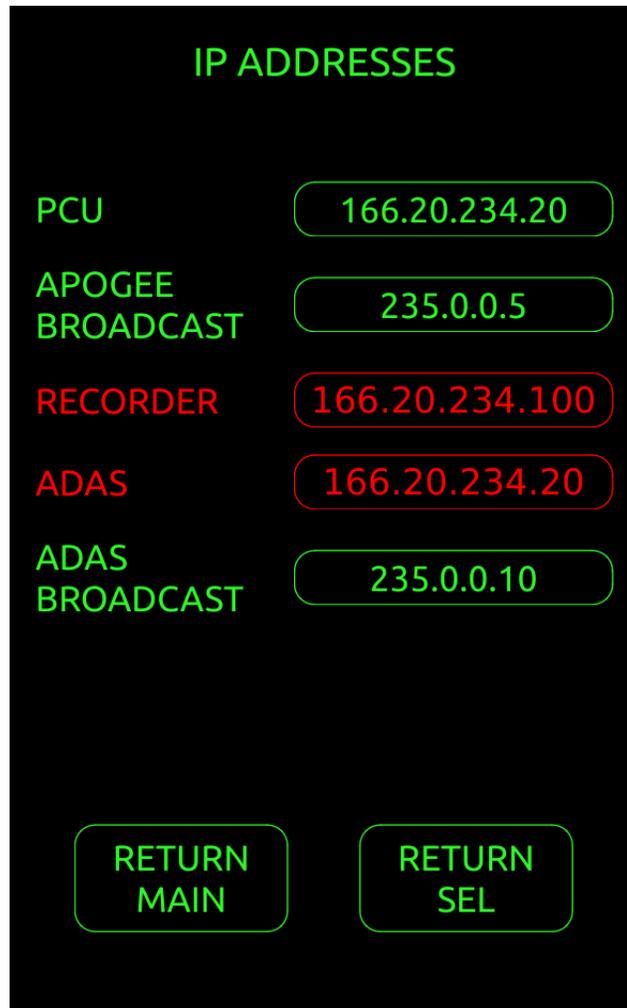
Figure 14: IP Address Page

3.12.1 Connection Status

The IP address page will display the connection status to the recorder and master DAU device. Devices which have a connection are shown in green. Lost connections are shown in red.

3.12.2 Changing IP Addresses

To change any of the IP Addresses on this page, the user must press the desired IP Address button and a keypad will be displayed. When changing the IP Address of the PCU, the user will be prompted to

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set the IP Address, Netmask, and Gateway. These values are saved in the INI.txt file and are restored at power up time.

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3.13 SETTINGS PAGE

The setting page will allow the operator to adjust the volume output on the audio channel, adjust the screen brightneess, set the press delay, and calibrate the touchscreen, update gauges, and show version information.
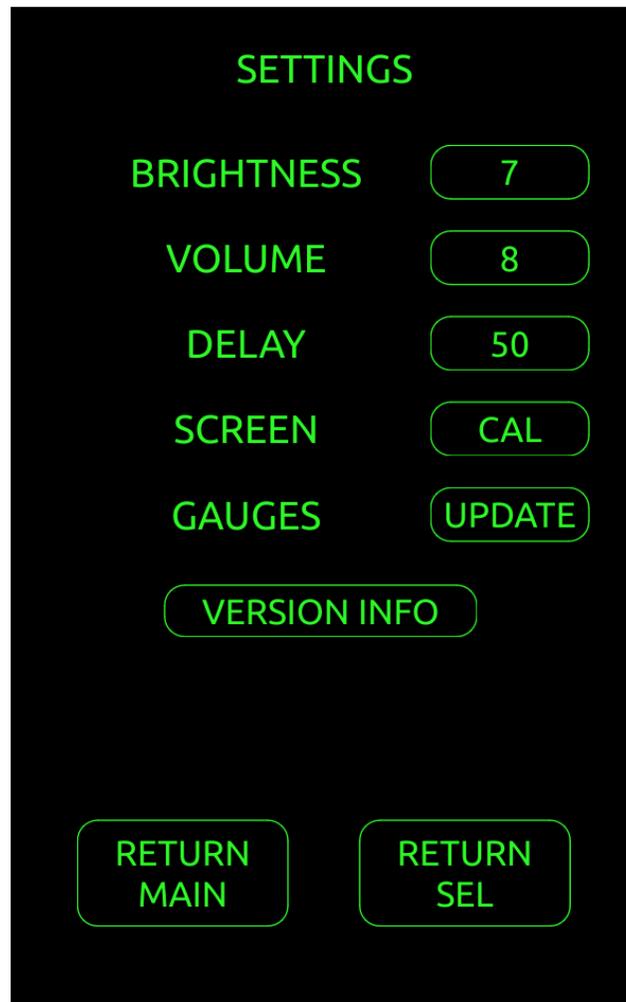
Figure 15: Settings Page

3.13.1 Adjusting the Brightness

When the brightness button is pressed a slider will be displayed allowing the user to change the brightness. To adjust the brightness, press and drag the leading edge of the green bar. As the slider is moved, the screen brightness will actively change. Press the Done button to return to the settings page.

Figure 16: Brightness Slider

3.13.2   Adjusting the Volume

When the volume button is pressed a slider will be displayed allowing the user to set the volume. To adjust the volume, press and drag the leading edge of the green bar. As the volume is adjusted, an audible beep will be played at the new volume setting. Press the Done button to return to the settings page.

Figure 17: Volume Slider

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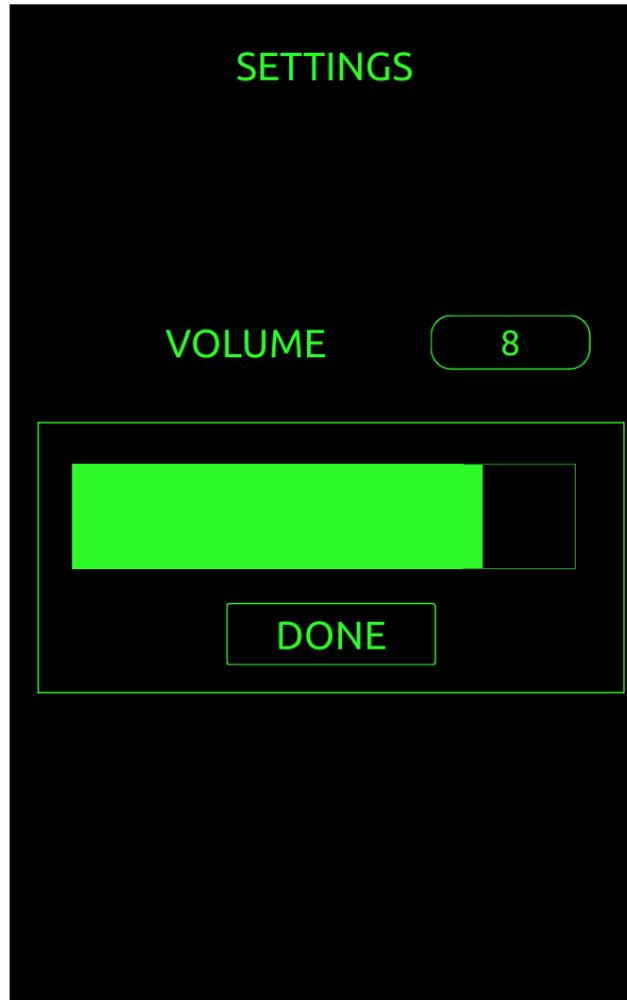
3.13.3   User Defined Press Delay

The D field sets in milliseconds how long the user must press certain buttons in order for them to trigger an action. On the main page of the PCU, the EVENT value field button (in the middle screen area) and the SEL button will not activate the desired feature until the button is held for the delay value time. Also on the main page of the PCU, the PRIME and EVENT button (in the bottom of the screen area) are debounced by the delay value, so that once pressed, they will immediately activate, but not activate again until the delay value has expired. The valid range for press delay is between 0 and 5000 milliseconds. Any other entry into the keypad will not be accepted and the SET DELAY label will change RED. (see figure below)

Figure 18: Set Delay Error

3.13.4   Calibrating the Touchscreen

Pressing the CAL button next to the SCREEN label will launch the PCU's touchscreen calibration program. To calibrate the touchscreen follow the on-screen instructions and press the pointers in each corner of the screen. After the calibration is complete the main program will restart. If you do not wish to recalibrate the touchscreen, don't press any of the on-screen pointers, and the calibration program will time out and then the main program will restart.

3.13.5   Gauges Update Button

Pressing the update gauges button reloads the gauge pages contained in the FTP server's *pub* directory on the AL529. This button allows the user to upload new .page files to the unit and refresh the gauges without restarting the unit.

3.13.6   Version Info Button

The version info button brings up a popup window that displays the current revision of the main software program and all relevant library packages.
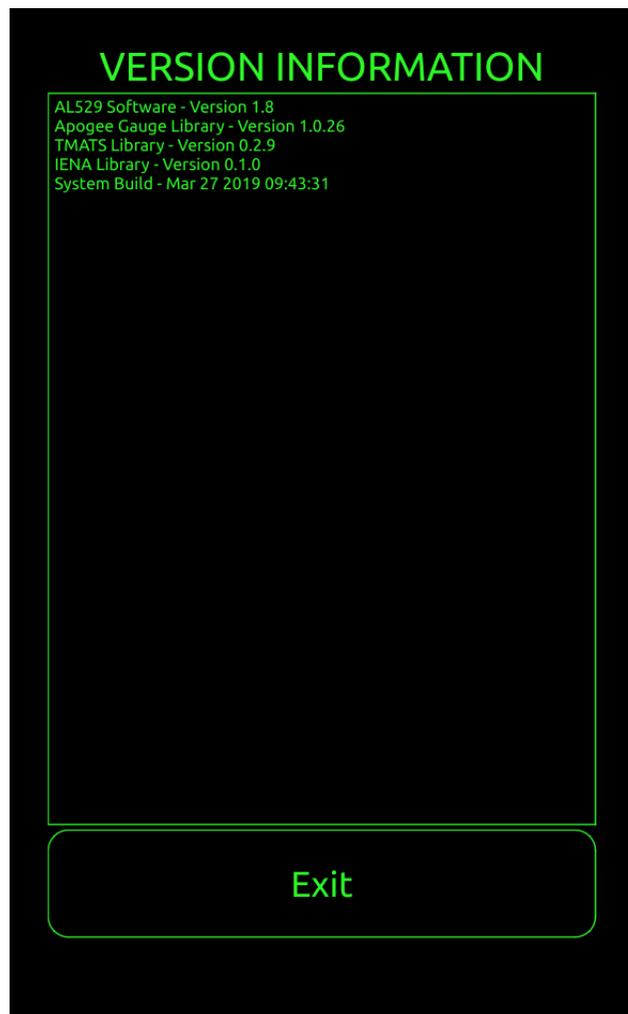
Figure 19: Version Information

4. : **PCU DATA**

4.1 PARAMETER DEFINITION

The PCU will retain the following parameters in non-volatile memory when the unit is shut down: **Aircraft Number**, **Test Number**, and **Event Number**. When the master DAU is modified to contain non-volatile memory, upon power-on, the PCU shall check the *Aircraft Number*, *Test Number* and *Event Number* values against those stored in the DAU, then prompt the user to select which value to use if they do not agree. The PCU will also retain the values of the **Operator Defined Parameters** from the ODP.txt file.

4.1.1 PCU Status Broadcast

By default, the PCU will broadcast a data packet on port 54000 which is captured by the Ethernet Bus Monitor card. Initially this will be the only way to place data into the PCM stream for all parameters. You can change the port number of this broadcast message, by setting the parameter named **apogeebroadcastport** in the INI.txt file. If this parameter does not exist, the PCU will default to using port 54000. The broadcast address is set using the parameter named **apogeebroadcast** in the INI.txt file.

The following table shows the packet format of the Broadcast Packet. The PCU broadcast should not byte swap the packet data. The **Operator Defined Parameter** values (listed as *ODP parameter_name_1* through *ODP parameter_name_10*) will be added to the broadcast message in big-Endian format. If an ODP parameter is not enabled in the ODP.txt file, that associated entry in the broadcast message will be zeros.

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Parameter	Payload Location In Bytes	Format
Message Type	0 – 1	2 = PCU Status Broadcast Rev B
Message Number	2 – 3	Increments by 1 with each packet
Version	4 – 5	PCU Status Broadcast Version
Aircraft Number	6 – 7	16 bit Unsigned Integer
Test Number	8 – 9	16 bit Unsigned Integer
Event Number	10 – 11	16 bit Unsigned Integer
Recorder State	12 – 13	Discrete *(See table 5)*
Memory - Remaining Memory In Minutes	14 – 15	16 bit Unsigned Integer
Reserved	16 – 17	TBD
Reserved	18 – 19	TBD
Cal State	20 – 21	See L3 Network ICD
PCU SW Version	22 – 23	MSB – Major Version LSB – Minor Version
ODP parameter_name_1	24 – 27	32 bit Float, big-Endian
ODP parameter_name_2	28 – 31	32 bit Float, big-Endian
ODP parameter_name_3	32 – 35	32 bit Float, big-Endian
ODP parameter_name_4	36 – 39	32 bit Float, big-Endian
ODP parameter_name_5	40 – 43	32 bit Float, big-Endian
ODP parameter_name_6	44 – 47	32 bit Float, big-Endian
ODP parameter_name_7	48 – 51	32 bit Float, big-Endian
ODP parameter_name_8	52 – 55	32 bit Float, big-Endian
ODP parameter_name_9	56 – 59	32 bit Float, big-Endian
ODP parameter_name_10	60 – 63	32 bit Float, big-Endian
Health 0-N	64 to N*4-1	32 bit Health words from recorder status

Table 4: Broadcast Packet Definition

4.1.2 Recorder State

The *Recorder State* word used in payload location 4 of the Payload Data Definition is as follows:

MSB	Most Significant Byte						LSB
15	14	13	12	11	10	9	8
Record-ing	Stopped	Prime Data	Event Pressed	Recorder Fail	End of Memory		
MSB	Least Significant Byte						LSB
7	6	5	4	3	2	1	0
Binary GBytes Remaining							

Table 5: Recorder State Word Definition

4.1.3 Recorder Health Status Words

The *Recorder Health Status* words starting at the location beyond the Operator Defined Parameters of the Payload Data Definition are defined in the following manner:

```
        .HEALTH
0     00000000 SYSTEM
1     00000000 TIMEIN
2     00000000 ANAIN-1
3     -------- PCMIN-1
4     00000034 PCMIN-2
           :
15 00000000 1553IN-8
```

Note: "--------" in the health indicates that the channel is disabled. The PCU will set all bits to one for a channel that is disabled. The number of Recorder Health Status Words in the Status Broadcast packet depends on the *health* parameter that is defined in the *health.txt* file, which is located in the FTP's *pub* directory. If this file is not present, there will not be any Recorder Health Status Words. If the file is present, but there is not a recorder, the data will be all zeros.

4.1.4 Setting the Master DAU General Purpose Registers

The PCU will set the General Purpose register 1-7 with the data shown in the *Payload Data Definition* table. The Cal State bits *xxx* are read from the Master DAU and represent the current value of the system data acquisition state. Bits *yyy* represent the commanded cal state of the system, as set by the PCU.

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5. : UPDATING THE AL529

5.1 FTP SERVER

The AL529 has an FTP server available for uploading files. Users can upload files to the server using an anonymous login with a blank password. The server's folder structure is defined as follows:
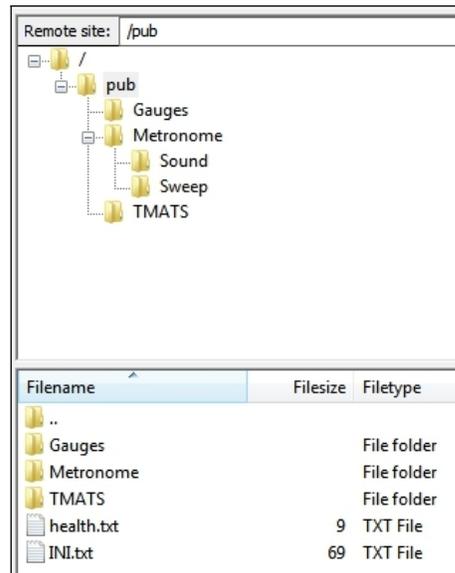
Figure 20: FTP Server Directory Structure

5.1.1 FTP pub Directory

The PCU's FTP pub directory contains all folders necessary for various functions of the PCU to operate. There are two files contained in the pub directory at all times: **health.txt** and **INI.txt**. Another file named **ODP.txt** can also be located in the pub directory. The contents of these files are described in appendices at the end of this document.

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5.1.2   Gauges Directory
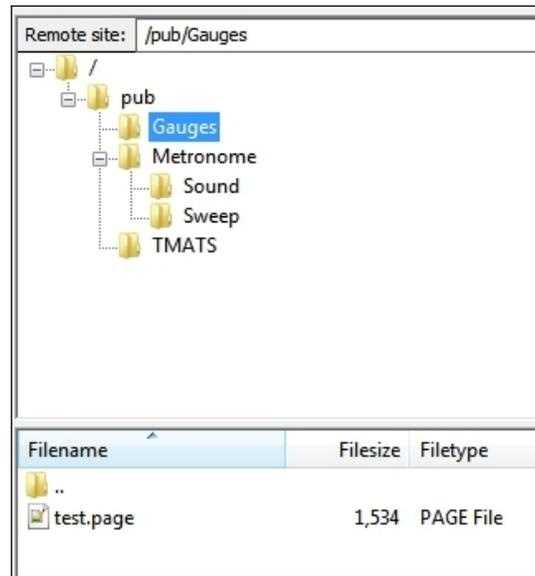
Figure 21: Gauges Directory

You can use the Apogee Labs Gauge Setup Software to create custom page files to display on the AL529. The resolution of these page files should be set to 900 x 1140. These files will have the .page filename extension, and need to be placed into the FTP server's pub/Gauges directory. Make sure that your custom page files utilize the same TMATS file that is in the TMATS directory, as the PCU only supports one TMATS file being on the system.

Use an FTP client to transfer your custom page files into the pub/Gauges directory, and then go to SEL / SETTINGS and press the UPDATE button next to the GAUGES label.

The PCU can display up to five custom gauge pages, by using the up and down arrows on the top corners of the operating frame. If there are more than five page files loaded into this directory, only the first five pages (in alphabetical order) will be accessible.

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5.1.3 TMATS Directory
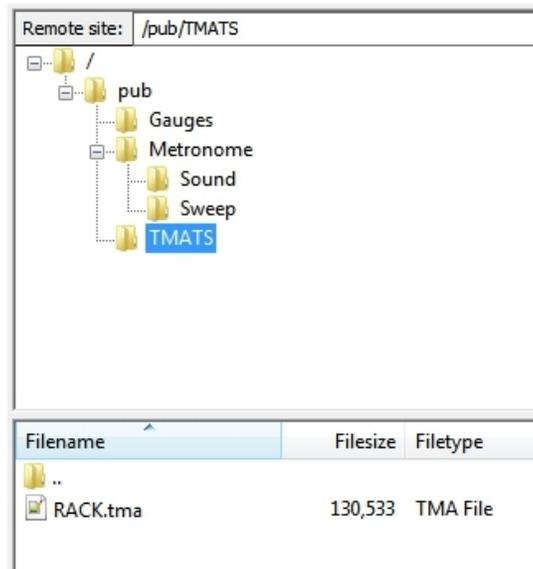
Figure 22: TMATS Directory

The TMATS directory contains the TMATS configuration file for the DECOM page and any custom gauge pages that are loaded onto the AL529. There must be only one TMATS file loaded on the system at a time. If more or less than one TMATS file is loaded in this directory, an error message will be displayed on the DECOM page.

5.1.4   Metronome Directory

The Metronome directory contains the Sound and Sweep directories which contain the files necessary for the Metronome Page to operate correctly.

5.1.4.1 Sound Directory
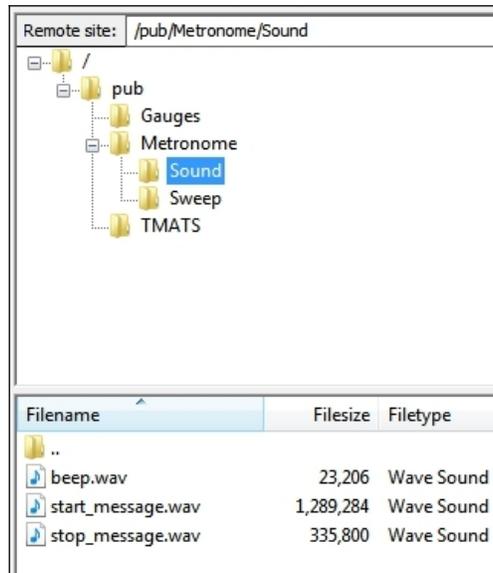
Figure 23: Sound Directory

The Sound directory should only contain 3 files: *beep.wav*, *start_message.wav*, and *stop_message.wav*. The files should be .wav files (other audio formats are not supported).

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5.1.4.2 Sweep Directory
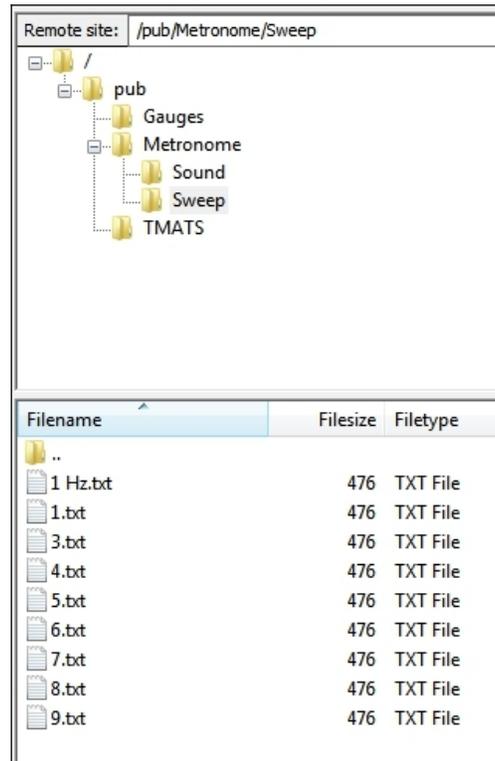
Figure 24: Sweep Directory

The Sweep directory should only contain valid sweep files (*.txt). The sweep files are defined in the appendix at the end of this document.

5.2 SOFTWARE UPDATE

In the event that a software update is required for the PCU, the user will ftp an update file to the PCU anonymously, in binary mode, and put the file in the **pub** folder. After the transfer is complete the unit will automatically reboot. On reboot the unit will run the update program and upon successful completion will start the new version of the software. To revert to an older version of software the user must upload the previous version's update file.

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6. : HARDWARE

6.1 CONNECTORS

The AL529 display can be utilized by itself (FZ-G1 tablet only), or with a Toughpad desktop cradle, which has several connectors on it. Only the power connector and Ethernet connector are used by the AL529.

If using the Toughpad desktop cradle, connect the power supply cable to the desktop cradle's power connector, and insert an active Ethernet cable into the cradle's Ethernet jack.

If using the AL529 display without the desktop cradle, connect the power supply cable to the FZ-G1's power connector and insert an active Ethernet cable into the FZ-G1's Ethernet jack.

6.2 CLEANING

The use of a dry, clean, microfiber cloth is recommended for cleaning all of the AL529BT surfaces, in-cluding the display. Avoid using any chemicals which could damage the display.

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7. : OPERATION

7.1 KEYPAD OPERATIONS

All keypad operations on the AL529 are software based and operated using the touchscreen.

7.2 FRONT PANEL BUTTONS

7.2.1 POWER BUTTON

There is a power button located on the front panel of the AL529. When the device is off, press and release the power button to start the system. When the device is on, press and release the power button to power down the system.

7.2.2 OTHER BUTTONS

There are six other buttons located on the front panel of the AL529.
- The A1 button is the same as pressing the SEL button and brings up the menu.
- The A2 button brings up the TEST INFO screen.
- The Volume Down button operates the same as pressing the Down Arrow on the touchscreen.
- The Volume Up button operates the same as pressing the Up Arrow on the touchscreen.
- The Windows Logo button performs a Min/Peak Hold reset on the currently loaded user page file.
- The Rotation button toggles the strip chart pause/un-pause functionality on the currently loaded user page file.

7.3 BRIGHTNESS ADJUSTMENT

The screen brightness is adjusted from the AL529 menu system as detailed in Chapter 3.

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APPENDIX 1.   INI.TXT DEFINITION

The **INI.txt** file contained in the pub directory of the AL529's ftp server is a flat text file that enables or disables the optional metronome and camera control pages. Here is a full example INI.txt file which shows all available parameters for the system:

```
# Network
ipaddress=192.168.0.49
netmask=255.255.255.0
gateway=192.168.0.1
adas=166.20.234.20
adasport=54000
adasbroadcast=235.0.0.10
adasbroadcastport=54002
apogeebroadcast=239.0.0.1
apogeebroadcastport=54000
recorder=166.20.234.100

# Camera
camera=on
camera1=166.20.234.61
camera1label=Fwd Starboard
camera1xy=200, 100
camera2=166.20.234.62
camera2label=Aft Starboard
camera2xy=200, 800
group1=Fwd Cameras
group1cameras=1
group1xy=500, 160
group2=All Cameras
group2cameras=1, 2
group2xy=500, 510
group3=Aft Cameras
group3cameras=2
group3xy=500, 860

# Misc
metronome=on
opmode=PCU
orientation=left
longpresstime=1000
timemode=recorder
ptpserver=192.168.0.201
```

The lines which begin with the pound sign (#) are comments. The order of the parameters in the file does not matter, so separating them like this can aid in readability.

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All words must be lowercase and there cannot be any spaces between the keyword, equal sign, or value. If any of these keywords (or the file itself) are missing, the AL529 will assign appropriate default system values.

The parameters listed under the **# Network** comment are related to the network operation of the system.

> `ipaddress, netmask` and `gateway` are the variables used to configure the IP address of the PCU itself. These values are reflected on the IP ADDRESS page.

> `recorder` is the variable used to configure the IP address of the recorder. This value is reflected on the IP ADDRESS page.

> `apogeebroadcast` and `apogeebroadcastport` are the variable used to configure the multicast IP address and port number that the PCU uses to send its broadcast message. This value is reflected on the IP ADDRESS page. If the port number is not specified, the PCU defaults to 54000.

> `adas` is the variable used to configure the IP address of the ADAS system. This value is reflected on the IP ADDRESS page. `adasport` is the variable used to configure the port number of the ADAS system. This value is not accessible via the menu system.

> `adasbroadcast` and `adasbroadcastport` are the variables used to configure the multicast IP address of the ADAS client.

The parameters listed under the **# Camera** comment are related to the optional IDT camera system. If the camera parameter is not set **=on** then the camera page will not be displayed, and the system will have no camera functionality.

The other parameters under the **# Camera** comment are defined in section 3.4 earlier in this document.

The parameters listed under the **# misc** comment are other system related paameters.

> The **metronome=** parameter defines if the metronome screen is enabled. A value of **yes** enables the metronome screen. A value of **no** disables it.

> The **opmode=** parameter defines the system operation mode of the system. A value of PCU configures the system to operate in PCU mode. A value of GAUGES configures the system to operate in Gauges mode, with the AL529BT software.

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The **orientation=** parameter defines the screen rotation of the display. The valid values for this parameter are **normal**, **left**, **right** and **inverted** :

> **normal** : The display operates in a landscape orientation, with the display's physical buttons on the bottom and the power cord on the left bottom.
>
> **left** : The display operates in a portrait orientation, with the display's physical buttons on the left and the power cord on the top left.
>
> **right** : The display operates in a portrait orientation, with the display's physical buttons on the right and the power cord on the bottom right.
>
> **inverted** : The display operates in a landscape orientation, with the display's physical buttons on the top and the power cord on the right top.

The **longpresstime=** parameter configures the amount of milliseconds for a long press to be detected on an XY Crossplot gauge, located on a user page. The gauge needs to be configured so that the Target Area is enabled, and is using the Offsets Target Mode. After the gauge detects that the amount of time has been reached to create a long press, releasing the touch will recenter the origin of the Target Area to the gauge's default X/Y location. A short press of the gauge will recenter the origin of the Target Area at the location where the touch occurred. Setting the value to 0 disables this functionality. The default value for this parameter is **1000**

The available **timemode=** parameter configures the time system operation of the PCU software. If this parameter has a value of **ptp** , then the PCU will operate in the new PTP time mode, instead of the legacy Recorder IRIG time mode. If this parameter is not set, or has a value of **recorder** , the system defaults to the legacy Recorder IRIG time mode.

The available **ptpserver=** parameter is used in conjunction with the new PTP time mode. The value should be set equal to the IP address of the OnTime network switch which is providing the PTP time. If PTP time mode is enabled, pressing the PTP Time button will enable the user to enter a date/time and send it to the OnTime network switch, using the value of this parameter.

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APPENDIX 2.   HEALTH.TXT DEFINITION

The **health.txt** file contained in the pub directory of the AL529's FTP server is a flat text file that controls how many health status words are inserted into the broadcast stream of the PCU. The keyword and options are as follows:

- health=<# of words>

All words must be lowercase and there cannot be any spaces between the keyword, equal sign, or value. If the keyword (or the file itself) is missing the AL529 will use the default setting of broadcasting all available health status words.

APPENDIX 3.   ODP.TXT DEFINITION

The **ODP.txt** file contained in the pub directory of the AL529's ftp server is a flat text file that controls which Operator Defined Parameters appear on the FLIGHT INFO page, and in the broadcast stream of the PCU. Up to ten ODPs can be added to the file. The keyword and options are as follows:

- parameter_name_1=NAME_STRING
- parameter_value_1=VALUE_STRING
- ...
- parameter_name_10=NAME_STRING
- parameter_value_10=VALUE_STRING

All words on the left of the equal sign must be lowercase and there cannot be any spaces between the keyword, equal sign, or value. Only parameters 1 through 10 are permitted, and the order that they appear in the file is not important. The VALUE_STRING must represent a valid floating point number.

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APPENDIX 4.   SWEEP FILES

The sweep files contained in the /pub/Metronome/Sweep/ directory control how the metronome page functions. The elements contained in each sweep file define how fast the metronome moves and how often the beep.wav file is played.   The sweep file must have the following elements:

Line	Data Element
1	File Name (should match name of txt file)
2	Rate that data is updated in updates per second (Typ. 20, max 50)
3	N the Number of data values in the file
4	Value 1
5	Value 2
N+3	Value N

Table 6: Sweep File Format

The values must have a value from (-1.0 to 1.0) in .1 increments. These values represent the location of the ball on the metronome along the X axis, where -1.0 is the far left side, 0 is the middle, and 1.0 is on the far right side. The beep will play when the ball changes direction.

If the sweep file contains errors, an error message will be displayed on the PCU's screen when the in-valid file is selected. The possible error conditions are as follows:

Error	Details
OPEN ERROR	Generic file open error.
VALUE MISMATCH	Number of values does not equal value reported in line 3.
DATA ERROR	No valid values reported in file.
INVALID RATE	Refresh rate must be greater than 0 and less than 51.

Table 7: Sweep Errors