RSU

Ruggedized Service Unit Tester and Transcriber

Operations Manual

Part Number
900-0108 ver. 030801

avionica

inc.

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Warranty

The Avionica RSU is warranted against defects in materials or workmanship for a period of one (1) year from the date of original purchase. Avionica's sole liability shall be to repair or replace the product, at its discretion.

Units returned for warranty claims must be accompanied by a previously issued RMA number. RMA's are issued by the Avionica Customer Service Dept. at (305)559-9194. One-way express freight will be paid by Avionica to return the repaired/replaced unit to the customer (domestic only). Units will be returned to international customers via international first-class postage.

This warranty is void if seals on adapters have been tampered with, or if there is obvious misuse, damage, or contamination to the product. Avionica is the sole judge in matters of misuse.

License Agreement

The software installed in the RSU is licensed to the user for use on a single computer controlled by the user. The user acknowledges and agrees that this software is a proprietary product, of commercial value to Avionica, and protected under U.S. copyright and trade secret laws of general applicability. This License Agreement does not convey to the user any interest in or to the software, but only a limited right of use in accordance with this License Agreement and the below stated Disclaimer. As such, any sale or lease of this software by the user to a third party is prohibited. By executing this software, the user agrees to all the terms of this License Agreement and the below stated Disclaimer.

Disclaimer

Avionica makes no claims as to the fitness of this product for a particular task. It is the sole responsibility of the user to determine the fitness of this product for the task at hand. Avionica will not be liable for losses or damages resulting from use or misuse of this product. IBM, Microsoft, Allied-Signal, Sundstrand, L3 Communications, Fairchild, Loral, and Lockheed and any of their product names mentioned herein are trademarks, property of their respective companies.

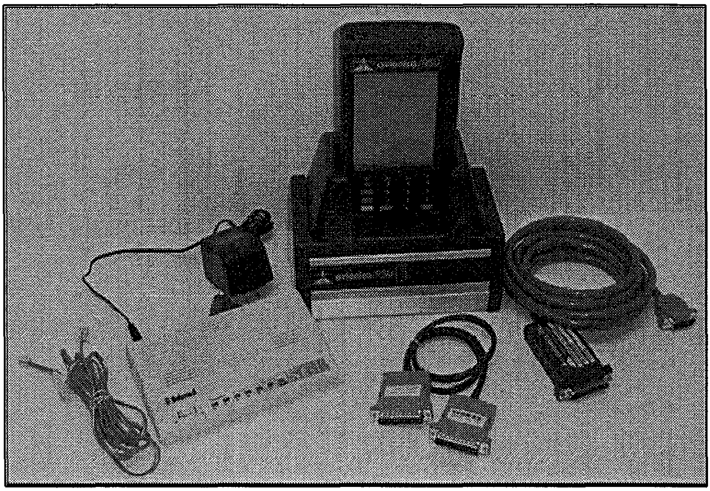
Revision Policy

Software improvements will periodically be made at the discretion of Avionica. A notification system designed to be integrated with the calibration assurance department of each customer will inform when software updates become available. In most cases, updates can be accomplished electronically making the task of ensuring the latest version traceable and simple.

Contents

This manual provides technical information plus installation and operating instructions for the **Avionica RSU P/N 650-0020**. The RSU is part of a system that incorporates ARINC 542/573/717/747 protocols for use as a Digital Flight Data Recorder Tester and Transcriber.

1.1 Introduction



Avionica's Ruggedized Service Unit (RSU) is a powerful, small, rugged, and flexible diagnostic tool that features keypad or touch screen input capability with integrated assistance prompts. It offers a modular expansion capability that allows users to begin with a basic system and build on it as needs increase. Power from rechargeable lithium batteries provides staying power to perform for long periods on a single charge.

Connected to a Flight Data Recorder, it enables the user to view data passing through most FDR's in real time, displaying parameters in engineering units, octal, decimal and binary formats simultaneously. If preferred, an octal only reading screen is available. It also downloads data for further analysis from virtually all units fitted to commercial aircraft.

A list of these includes:

- Allied Signal™ SSFDR (980-4120-XXXX)
- Allied Signal™ SSFDR (980-4700-XXXX)
- Sundstrand™ UFDR (980-4100-XXXX)
- Lockheed™ 209 (10077A500)
- L3 Communications™ FA2100 (2100-4043-XXX)
- Fairchild™ F-1000 (S700, S800, S900 series)
- Fairchild™ F-800 (17M303, 17M903)
- British Aerospace™ SCR-500
- Penney & Giles™
- Plessey™ 1584G

With discrete interface cables attached, the RSU also monitors data directly from the following Data Acquisition Units in real time on board the aircraft:

- Teledyne™
- Hamilton-Standard™
- Telephonics™
- Plessey™
- SFIM™
- Allied Signal FDAMS™

The RSU monitors real-time data and transcribes data from the Avionica MiniQAR.

Using optional modules, the RSU may also be attached to Bendix and Collins TCAS computers to provide diagnostics.

2.0 TECHNICAL CHARACTERISTICS

The RSU receives Harvard Bi-phase signals compatible with ARINC 542, 542E, 573, 717, and 747 digital flight data recorders and RS-422.

Optionally fitted, it can also receive ARINC-429 data in support of ARINC-429 databus monitoring as well as TCAS computer system diagnostics and serve as an ARINC 615 Dataloader.

NOTE: The RSU is part of a data analysis system. It is not intended for use in testing or verifying ARINC electrical characteristics. All electrical characteristic tests should be carried out using appropriate waveform testing devices.

2.1 Technical Specifications

Size: 7 inches (17.78 cm) long
4.2 inches (10.67) wide
1.5 inches (3.81 cm) tall

Temperature:
Operating: 4 to + 140°F (-20 to + 60°)
Storage: -22 to + 158°F (-30 to +70°C)

Weight:
20 ounces (567 g); ounces (893 g) fully configured

Humidity: 5 to 95% noncondensing

Static Protection: 20 kV (air discharge) 8 kV (direct injected)

Power source:
Main battery: 7.2 V, 910 mA hour lithium ion battery pack(standard)
Backup battery: Two 3. V, 100 mA hour vanadium lithium battery (standard)

Charging rate:
0 to 60 °C: Fast charge (fully charge = 2.5 hours;
(+32 to 140 °F) 95% fully charged = 1.5 hours

Communications:
Interface: RS-232, RS-485, and Infrared
Protocol: Norand Proprietary Communications Protocol (NPCP), Xmodem, Ymodem, IrDA

System Components:
FLASH: 150 Megabyte (MB) FLASH array (standard)
DRAM: 2 Megabytes (standard)

Card Options: Two PC card slots; two Type II cards, or one Type III card.

Processor: AMD Elan chip 386 architecture, 33 Mhz.

Display:
Type: Quarter size VGA LCD, CGA Controller, with Backlight
Size: 240 (wide) by 320 (long) pixel, portrait orientation.

This section describes how the RSU forms the basis for Avionica's system architecture and provides inputs for Data Analysis and Transcription software.

3.1 RSU System Architecture

Avionica 's Flight Data Analysis system operates in two phases in order to maintain security of the data in the FDR. The first phase offers two separate functions. They include reading information passing through the FDR in "Real Time" or downloading data for further analysis. Three elements are required for this phase: an RSU, GP-573 Data Bus Analyzer/Transcriber software (which is installed in the RSU at Avionica's facility), and a discrete interface cable for each specific type of FDR. The Avionica system works with virtually all of the flight data recovery units now flying in the Western Hemisphere.

Most importantly, there is no need to remove the FDR from the aircraft. You may plug in to the FDR and use the "Real Time" mode for installation verification, maintenance troubleshooting, etc. You may also download all or part of the 25 hours of recorded data for analysis.

The second phase incorporates Avionica's optional ***AVSCAN.flight*** (see figure 1) analysis software. Using ***AVSCAN.flight***, it is possible to perform a full analysis of all 25 hours of data and completing a report in a matter of minutes, not hours or days. ***AVSCAN.flight*** enables the user to portray informational parameters in any desired combination and/or time perspective. Permitting examination of parameters in engineering unit and graphic formats simultaneously at speeds not previously possible, ***AVSCAN.flight*** raises excellence in flight data analysis and testing to a dramatic new level. Combined with ***AVSCAN.fleet*** (see figure 2), comprehensive and secure trend analysis essential to FOQA programs is now at everyone's fingertips.

Avionica's modular, building-block concept enables the user to add functionality to the RSU. As previously mentioned, Hardware and software options enable it to perform as a CDU Simulator, an ARINC 429 Databus analyzer, an ARINC 615 Dataloader and it is capable of downloading TCAS fault history. Ask Avionica for more details.

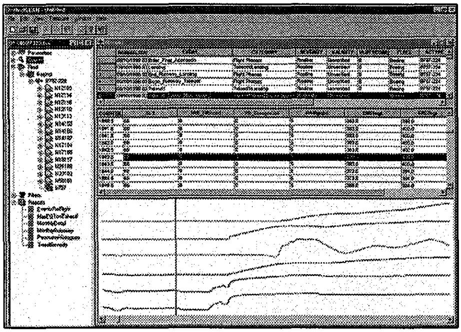


Figure 1

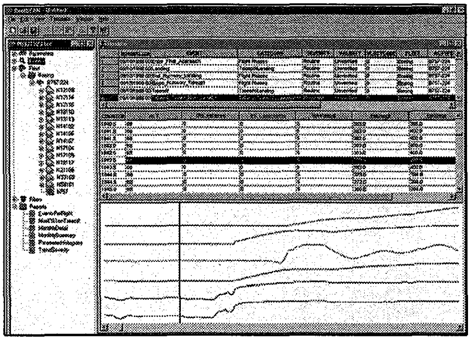


Figure 2

The Avionica RSU performs many functions and does them all well. For many, it has become an indispensable part of a complete avionics capability.

Carefully remove the RSU, the docking station and all electrical connectors. Inspect for any damage or loss incurred during shipment. If damage is evident save the shipping container to substantiate your claim with the carrier.

4.1 The Following Components are Included in Your Package:

1 ea.	Avionica's RSU (Ruggedized Service Unit)	650-0020
1 ea.	Avionica RSU case	650-0024
1 ea.	Docking station and wall outlet cable	650-0022
1 ea.	Flash Card (installed in the RSU)	650-0027
1 ea.	RSU Manual (This document)	900-0108
1 ea.	GP-573 Data Bus Analyzer/Transcriber (software pre-installed in the RSU at Avionica)	
1 ea.	Modem	650-0023
	Including	
	1 ea. Modem telephone cord	
	1 ea. Modem interface cable	650-0007
	1 ea. Modem power supply	
1 ea.	File transfer cable	650-0006

Discreet Interface Cables for specific FDR's (of variable types and quantities based on customer order).

For international customers an international modem (PN 650-0025) will be supplied. Power plugs and phone line connectors will vary from country to country and may need to be obtained locally.

For international customers the appropriate power supply cables will be needed for the Docking station and the optiona AC adapter (if ordered). If the cables supplied are not suitable they will need to be obtained locally.

If you believe anything is missing, please call Avionica Technical Services at: ☎(305) 559-9194, extension 141.

5.0 SYSTEM COMPONENTS

5.1 RSU Docking Station

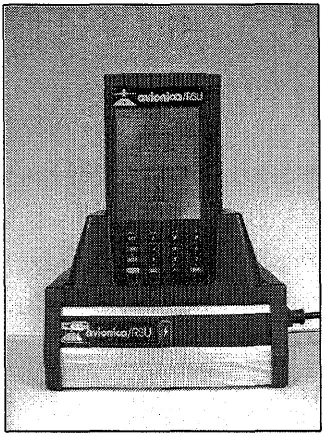


Figure 3

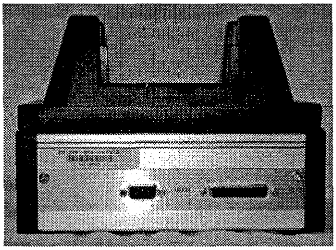


Figure 4

The RSU's docking station may be plugged into a source of external power from the receptacle on the right side with the power cord provided. Power is then available for recharging the RSU battery. It cradles the RSU as indicated in figure 3. External ports in the rear of the docking port (see figure 4) accommodate a modem for transfer of data. Fitting the RSU into the docking station cradle accomplishes several functions. The batteries are recharged and electrical connections associated with the docking connector are completed. An external modem is supplied to transfer data via telephone lines when appropriate. Modem specifications are variable to accommodate the host system and country requirements.

5.2 RSU Elements

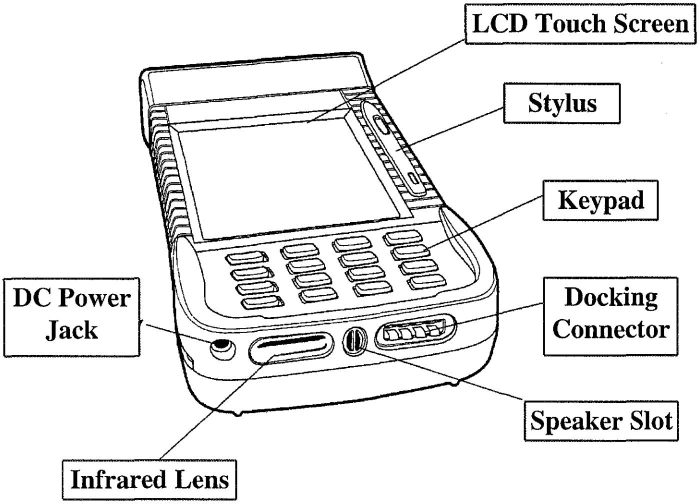


Figure 5

5.3 RSU LCD Screen

The RSU offers an easy to read Liquid Crystal Display (LCD) with touch screen. The touch screen can be used with a stylus (provided to the right of the screen) or your fingernail to choose functions or enter data.

CAUTION: Apply only very slight pressure to input data. Excessive pressure may damage the screen.

5.4 RSU Screen Illumination

The RSU display comes equipped with a backlight to aid in low light conditions. This feature DOES reduce battery life so it should be turned off when not necessary. Activate or deactivate this feature, by depressing the yellow button and then the number "9" button located on the RSU keypad.

5.5 Batteries

<u>NOTE</u>: *It is important to charge your RSU batteries for at least 14 hours before you use it the first time. This ensures that the backup battery and the main battery packs are fully charged.*

The RSU uses a 910 mA hour lithium ion rechargeable main battery pack. The battery pack has four LED's that will display remaining capacity when two of the contacts are touched at the same time.

If the RSU goes into a shutdown mode because of a low battery condition, data is protected by the backup batteries. These are two 100 mA hour vanadium lithium backup batteries that recharge themselves from the main pack or charging source.

Though not a guaranteed figure, the lithium ion rechargeable battery design should provide approximately 500 cycles of use.

5.6 Removing the Main Battery

As indicated in figure 6 below, press down and hold the release button for the battery compartment. Now slide the latch toward the release button and remove the battery.

The battery should not be removed while the RSU is attached to powered aircraft systems.

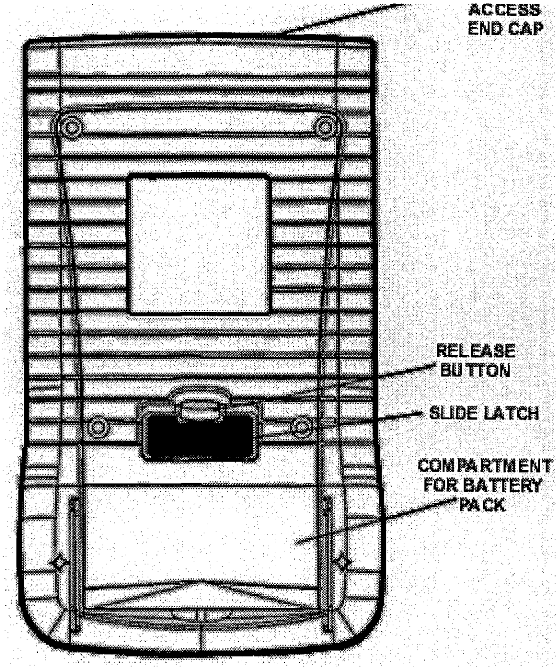


Figure 6

5.7 Measuring Battery Capacity

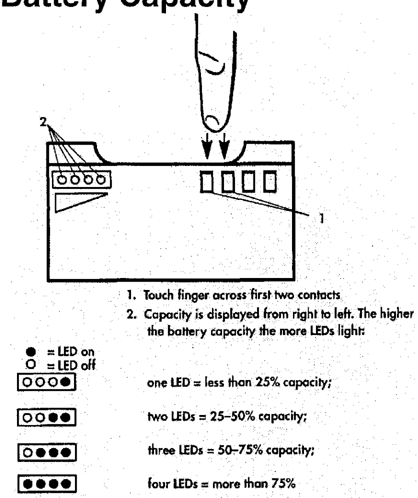


Figure 7

5.8 Reset Switch

In the rare event that the RSU fails to respond to inputs, it may be necessary to "reset." The reset switch is located behind the PC card endcap (see figure 8). To reset the RSU, use the tip of the stylus to press down on the small reset button. You will hear two beeps. Press and hold the "I/O" button on the keyboard until the screen stops scrolling. Press the "4" key. The screen will scroll some more, pause for 10 seconds, and resume scrolling. When scrolling has stopped press the green "Ent" key.

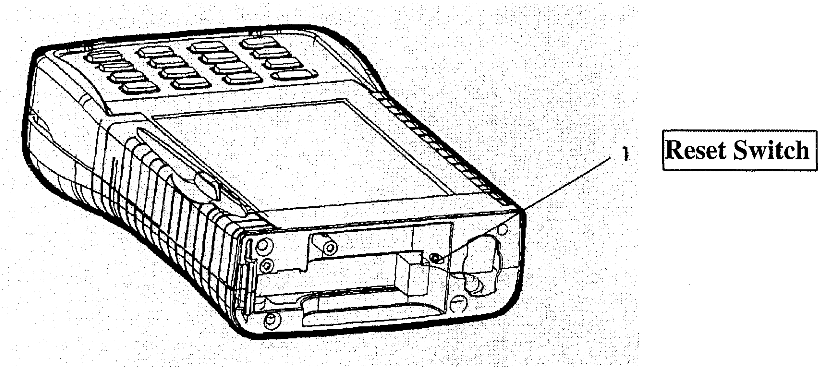


Figure 8

5.9 RSU Keyboard Functions

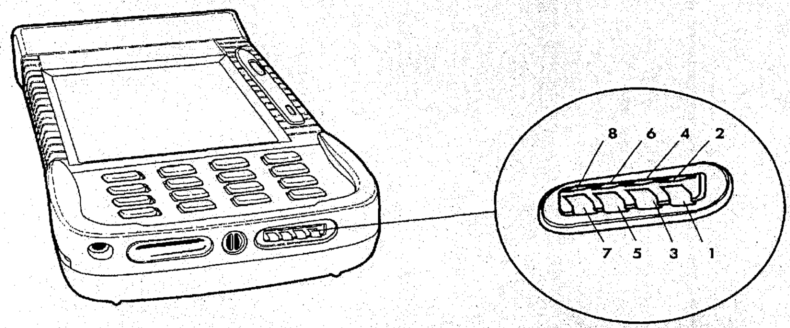
KEY	PRIMARY USE	SECONDARY FUNCTION
TAB	Switches from "Viewing Parameters" to "Viewing Raw Data" screens.	
BKSP	Used as in a PC when entering numeric keypad data.	
SHIFT	Enable secondary functions (The yellow key).	Soft reset (with ESC, 0, & ENT).
7		
4		
1		Left Arrow
ESC	Exit from "Viewing Parameters" or "Viewing Raw Data" screens to Main Menu. Also part of soft reset.	
5	Scroll up in "Viewing Parameters" Screen. Change sub-frames in "Raw Data Screen".	
2	Scroll down in "Viewing Parameters" Screen. Change sub-frames in "Raw Data Screen".	
0	Also part of soft reset.	
9		Backlight
6		
3		Right Arrow

ENT	Used as in a PC after entering numeric keypad data, or as a response to prompts. Also part of soft reset. (Green key)	

NOTE: All numeric keys, TAB, BSKP, LEFT (RIGHT) ARROW keys may be used for numeric data entry.

5.9 Eight-pin Docking Connector

8-Pin Docking Connector (standard)



Pin	Signal	Function
1	BCLK	Battery Clock
2	12.0 Volts	Terminal From Dock
3	GND	Ground
4	BDAT	Battery Data
5	TXD	Transmit for Serial Port
6	RXD	Receive for Serial Port
7	RTS	Ready To Send
8	CTS	Clear To Send

Figure 9

Sequential processes for reading data in real time or downloading data follow.

Before using the RSU on an aircraft it should be noted that power should be turned off on both the RSU and the FDR before connecting or disconnecting the RSU to the aircraft systems.

In order to turn the RSU on, depress the "I/O" button on the upper left corner of the keyboard for two seconds. This action activates the screen and the Main Menu. Conversely, to turn off the RSU, depress the "I/O" button, for two seconds and then release. If your RSU is NOT at the Main Menu when you turn it on, you may use the BACK or START over options on the screen to get there.

The Main Menu offers two options, "Aircraft Functions" and "Communications". The Main Menu also displays the revision number of your software. Directly below the line reading "Ruggedized Service Unit" you will see an abbreviation for your customer name and the date of the software revision (see figure 10). A "hidden" function in the main menu is the configuration screen. Tap on the logo and type 411 "Ent" at prompt to get there.

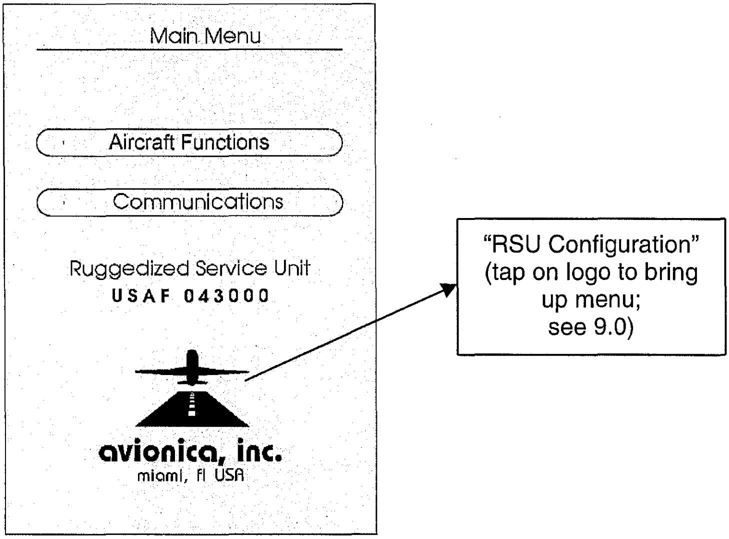


Figure 10

To monitor or download data press the stylus anywhere within the oval area surrounding "Aircraft Functions." The oval will highlight momentarily and change the screen to one titled "Aircraft Select" (see figure 11 below) if the fleet aircraft are programmed, or to one titled "Menu" if they are not. Procedures for using the RSU when the fleet is programmed will be covered first.

6.1 Fleet Programmed

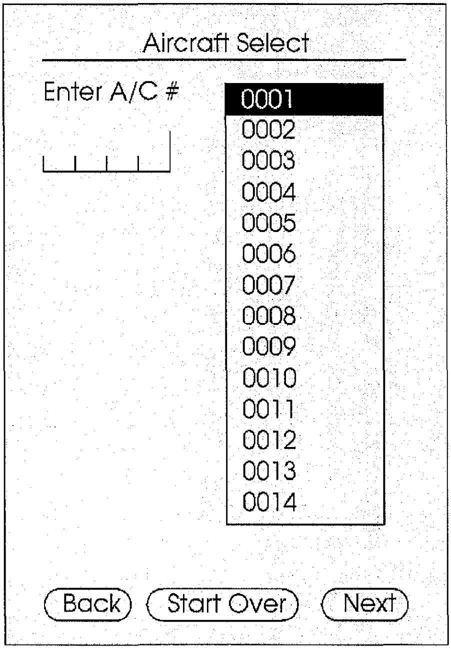


Figure 11

To select a particular aircraft press the screen over one of the programmed aircraft identifying numbers (see figure 11 above). This identifies the aircraft as one of the operator's fleet that has been programmed and allows the computer to call up the particular FDR/FDAU combination for that tail number. It bypasses the requirement to make those inputs manually. If your selection is not immediately visible, swipe the stylus past the bottom of the list column, and you'll notice that it scrolls. You may also swipe the stylus up past the top of the column to scroll in reverse. Try it!

If, after searching the list, you cannot find the aircraft number, then you must manually enter an aircraft tail number. This is because the pertinent information about that particular aircraft has not been programmed. Three methods (see below) can be used and additional steps will be required after you make your selection on the "Menu" screen described below (See section 6.2, "Fleet not Programmed").

If your organization uses a numeric tail number reference for your fleet, the most obvious method is to simply type the number in using the keypad.

Another method to manually enter an aircraft is to use the stylus as you would a pencil and write a 4-digit tail number in the block beneath the title "Enter A/C #." The screen will transpose your writing into printed numbers in the block (see figure 12). Experiment with this to see if it works for you. Left-handed users may have more difficulty than right-handed users.

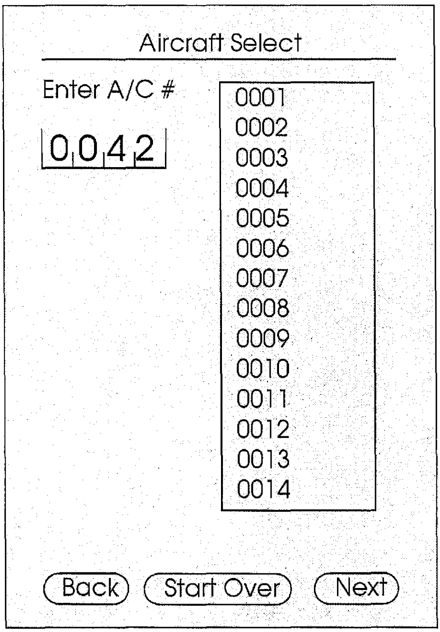


Figure 12

An alternate, positive method is to tap twice on the blocks under the words "Enter A/C #." An entry screen appears that will be superimposed on the view (see figure 13). By pressing on the appropriate figures, select or correct numbers. Then depress "OK" in the lower left to transfer the inputs onto the main screen and eliminate the numeric entry screen.

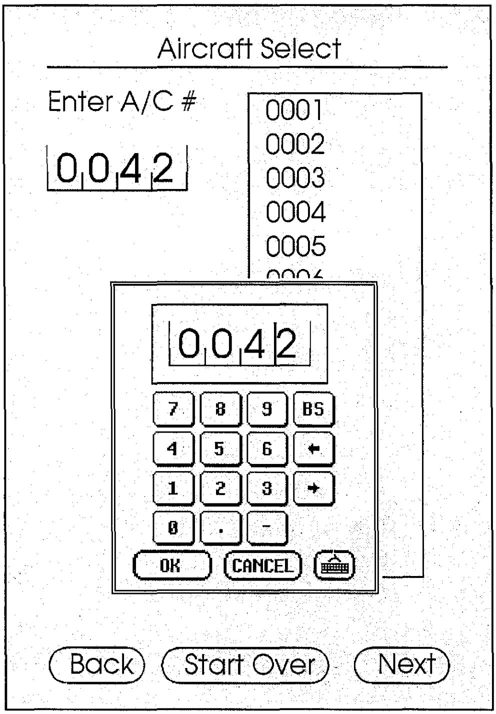


Figure 13

Pressing the word "Next" in the lower right oval will call up a screen titled "Menu" and offer the choices of "Monitor Flight Data" for reading real-time data either through the FDR or FDAU, or "Read DFDR Data" for downloading data from the FDR for further analysis. (see figure14).

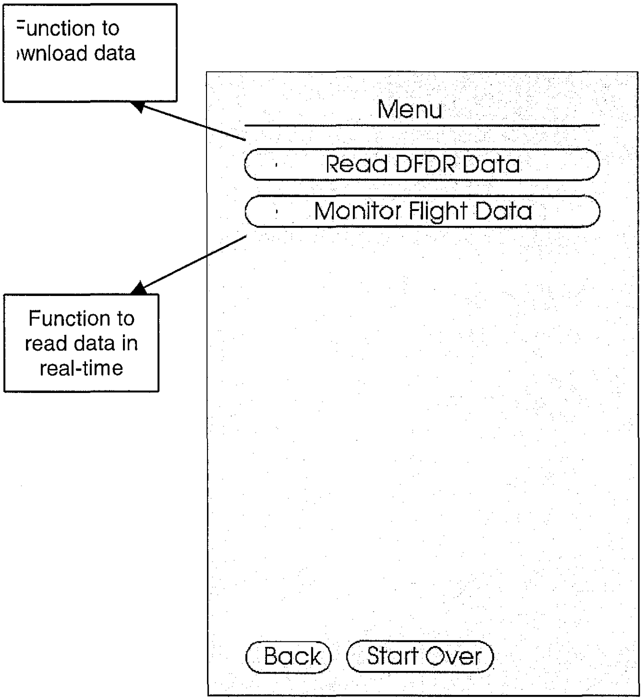


Figure 14

Each of these options will be addressed in detail beginning with section 6.3

6.2 Fleet Not Programmed

Some discussion is required for the two additional screens and inputs required for unprogrammed aircraft.

If the aircraft have been programmed into the computer, specifics on the type FDAU and FDR are part of the file. In this case, the computer will bypass the screens titled "FLEET Select" and "FDR Select" and the screen will shift directly to the "FDR Readout Setup" or "Flight Data Monitor Setup" depending on whether the monitor or read data function was selected earlier.

However, if the aircraft number has not been programmed, or if multiple devices are available on that aircraft to which the RSU may interface, a screen titled "FLEET Select" will appear.

This screen requires that you manually tell the system which of the available conversion (.prm) files to choose for the aircraft to which you'll be connecting the RSU. This is accomplished by pressing on your interface device selection with the stylus (see figure 15 below). All conversion files which your organization has purchased will be available.

Regardless of the configuration of the RSU, all RSU's contain the parameter files OCT64SFS, OCTAL128, and OCTAL256. Selecting one of these will "convert" each word's contents into octal units and display them as if they were individual parameters. Different formats are in use with 64 words per second being the most common. Some if the more modern recorders use 128 words per second and a few of the most recent use 256 words per second. The designations are self-evident (WORD_1, WORD_2, etc.). If you do not have a file for the particular plane you are working on you may always use an octal file.

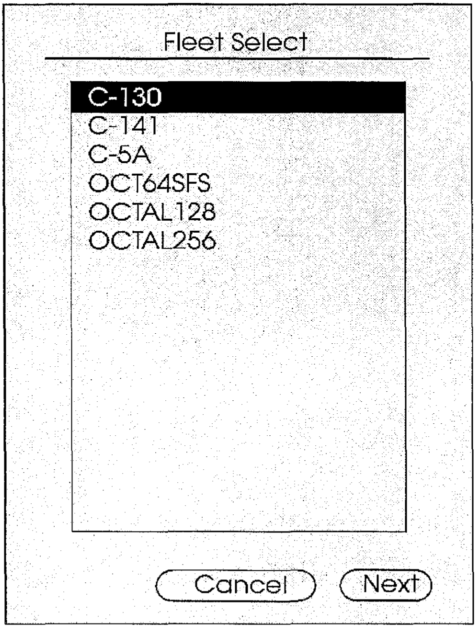


Figure 15

After inserting your selection, press the word “Next” in the lower right corner. This will transition you to the “FDR Select” screen (See figure 16 below).

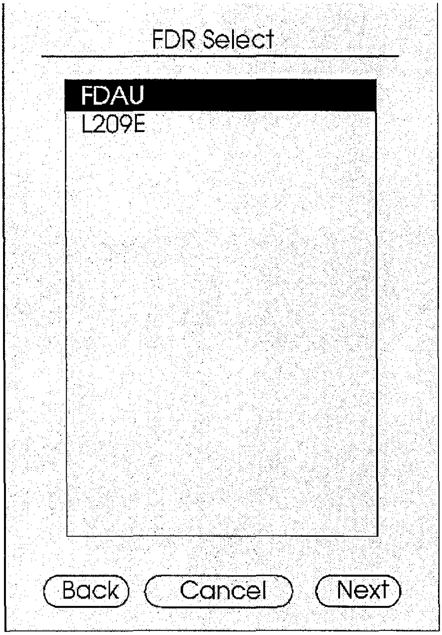


Figure 16

This screen requires that you manually tell the system which type of FDR (or other device) is installed in the aircraft and to which you'll be connecting the RSU. This is accomplished by pressing on your interface device selection with the stylus (see figure 16). All interfaces which your organization has purchased will be available.

Bear in mind that for some devices there are multiple drivers available. This is usually because they can operate in different modes or because there are a variety of interfaces available to them.

An F-800 in ARINC 542 (32 WPS) mode requires the F800-2 driver, while an F-800 in ARINC-573 (64 WPS) mode requires the F800 driver.

A Lockheed 209 interface of revision level "E" or later requires the L209E driver, while any previous interfaces require the L209 driver. The status is printed on the backshell of the interface.

If you have any questions please, please call Avionica Technical Services at 305-559-9194 extension 141.

6.3 Monitoring Data in "Real-Time"

By selecting " Monitor Flight Data", you direct the RSU to function in the real-time read mode. That action now displays a screen titled "Flight Data Monitor Setup" (see figure 17 below).

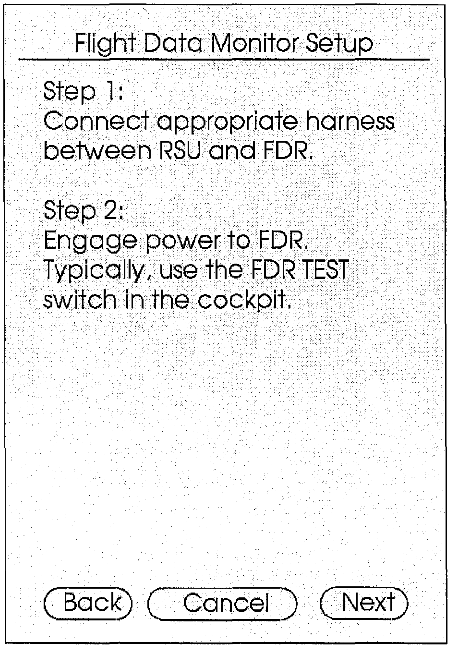


Figure 17

A screen titled "Viewing Parameters" will appear. It will be similar to the following. The actual screen contents will vary depending on the parameter file selected.

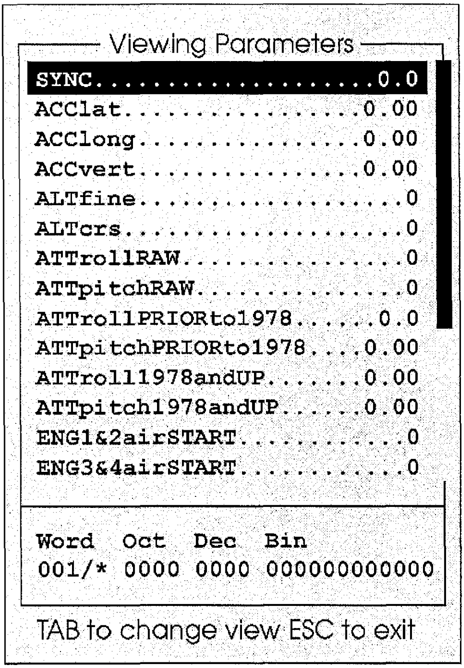


Figure 18A

All parameters recorded by the FDR may be viewed in real time, but due to screen size limitations, only 14 may be shown at once. All parameters shown will display real-time engineering units. One parameter will be highlighted. That one will also display the word number, and associated subframes (*=ALL, O=odd (1 & 3), and E=even (2 & 4)), along with the underlying octal number, and decimal and binary translations of that octal number simultaneously along the bottom of the screen. An X in the binary string implies that the indicated bit is not used in the particular parameter. See Figure 18A.

Each parameter may be highlighted in turn and remaining parameters may be viewed by using the "Up" and "Down" scroll keys on the keyboard to highlight a specific parameter. (These keys are also identified as "2" and "5".)

A provision exists to give the user an all octal code readout and that may be displayed by depressing the "Tab" key on the left of the keyboard. Depressing it again returns the screen to the original display. See Figure 18B.

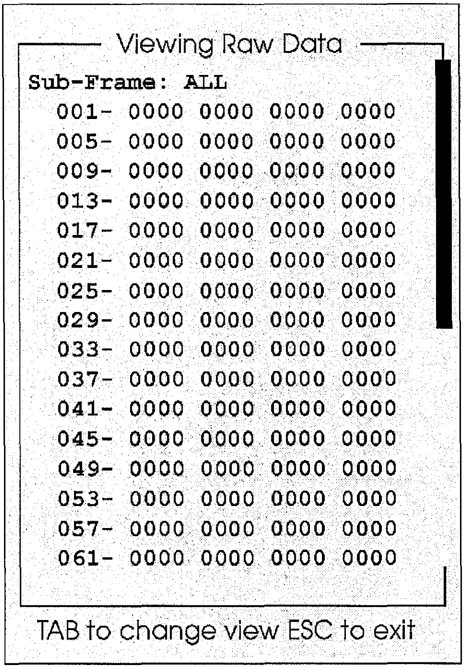


Figure 18B

Pressing the "5" or "2" key rotates between displaying ALL sub-frames, frame 1, frame 2, frame 3, or frame 4. As the prompt on the screen bottom indicates, depressing the "ESC" key exits this function and returns you to the "Menu" screen.

NOTE: Regardless of data frame size, only the first 64 words may be displayed in this octal screen. To see ALL words in octal, regardless of frame size, select one of the OCT64SFS, OCTAL128, or OCTAL256 parameter file entries as described above.

NOTE: Real Time data is updated once per second (each sub-frame). The F-1000 is an exception. It only updates once every 4 seconds. This is an artifact of the recorder, not the RSU.

6.4 Downloading Data from the FDR

By selecting the function "Read DFDR Data" from the Aircraft Functions Menu, you direct the RSU to function in the download mode. The "FDR Readout Setup" screen is then displayed (see figure 19 below).

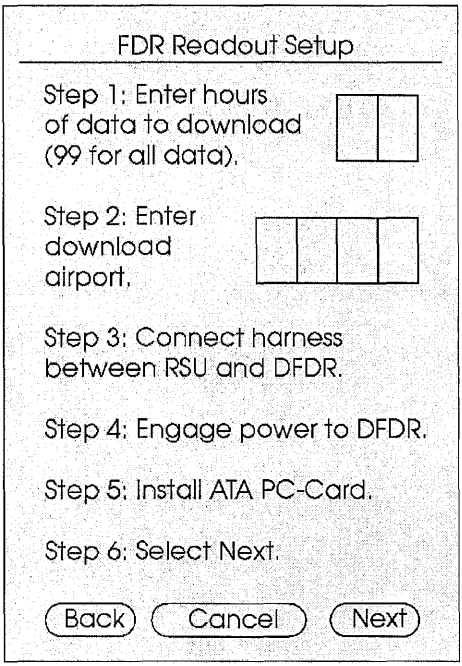


Figure 19

This screen consists of 6 steps, the first two requiring inputs from you and the remaining 4 providing you with a checklist.

Step ① requires that you tell the computer how many hours of data you wish to download. The adjacent blocks are where the information is entered.

Again, there are several means of entering data. You may simply type in the data using the numeric keypad, you may write the number of hours you wish to download in the blocks using the stylus as a pencil, or you can tap twice on the blocks to call up the numerical input overlay described earlier.

If you write the numbers, the screen will transpose them to block type. If you use the numerical input overlay, your entry will be applied to the field after selecting the numbers and pressing the "OK" field.

NOTE: Since modern recorders vary in the amount of actual data they can store (when compression is used), use the number 99 when a complete download is required.

Step ②_asks you to identify the airport or station where the download is taking place. Enter identifiers such as KMEM or KLAX. The "K" prefix is used in the U.S.A. Outside of the U.S.A., substitute the appropriate prefix.

As in step 1, you may use the stylus to write the identifier or tap twice on the input block to expose the (alphanumeric in this case) input overlay and select the appropriate characters followed by pressing the block marked "OK".

Steps ③ through ④ are checklist items and are self-explanatory. (See Section 10.0, "Connecting the RSU to the FDR" and Section 6.5, "Powering the Flight Recorder").

Step ⑤ is a reminder to check that the PCMCIA card is installed in the RSU. A card MUST always be installed in the RSU.

Execution of step ⑥ transitions the computer to the actual download screen screen and initiates the download sequences. After a few seconds, the screen will display the name and version of the initiated download driver program, and a "pacifier" indicating normal operation. If anomalies such as an unpowered FDR or an otherwise unsuccessful linkup exist, the screen will return to the main menu.

Again, under normal circumstances, the RSU will display a status screen indicating either:

1. An increasing percent of download transcription,
2. A block or byte count, or
3. A track count.

The displayed "pacifier" varies based on the technology of the recorder. The RSU attempts to pass along what download progress information the FDR passes along.

6.5 Powering the flight recorder.

Under normal circumstances, when an aircraft is on the ground with its rotating beacon off (standing still), the flight recorder is "Off." To power the recorder, it is necessary to place the cockpit switch in TEST or ON, depending on the aircraft type. See your specific Chapter 31 instructions for more information.

Ignore the condition of the associated indicator light. With the RSU attached, the recorder will automatically be placed in STANDBY mode when not transcribing (to prevent tape advance). The meaning of the indicator light varies from aircraft to aircraft. Please call Avionica Technical Services at 305-559-9194 extension 141 if you have questions.

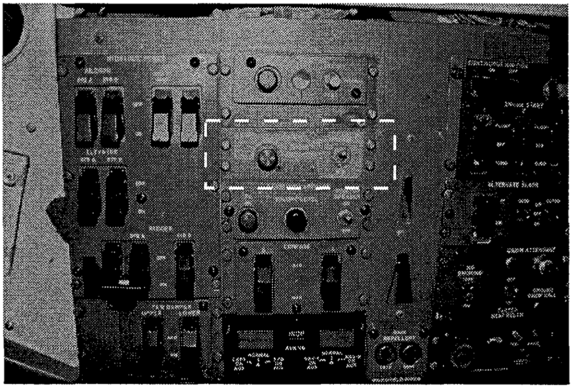


Figure 20

NOTE: DO NOT turn on the recorder until instructed to do so by the menu script.

NOTE: DO NOT connect/disconnect the RSU with power on the recorder.

NOTE: When downloading a tape based unit it is recommended that the RSU be powered from an AC source.

NOTE: The battery should not be removed while the RSU is attached to powered aircraft systems.

7.0 COMMUNICATIONS

Selecting "Communications" from the main menu provides the user with various accessory functions typically associated with the maintenance of previously downloaded data.

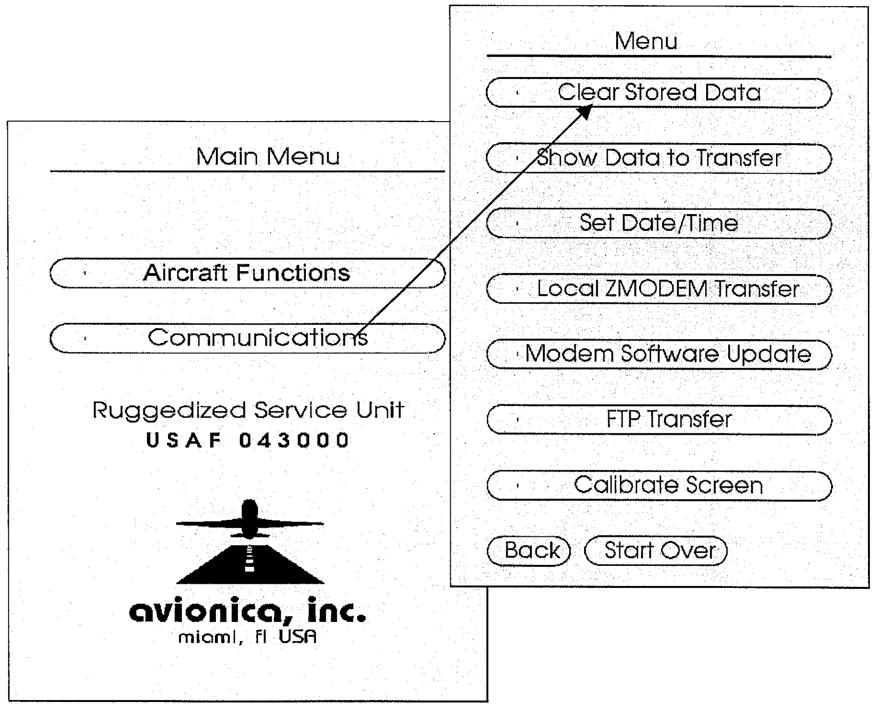


Figure 21

7.1 Clear Stored Data

The RSU will automatically clear any stored files after transferring a copy to a server with "FTP transfer". If you use other transfer options, however, or simply wish to clear any practice downloads, select the Clear Stored Data option from the communications menu. This will erase all readouts. Note that you will be presented with a confirmation prompt. Press "0" or "1" as directed to confirm.

7.2 Show Data to Transfer

Use this option to see if there are any files stored in the RSU awaiting transfer. If the previous FTP Transfer was successful, there should be none. This is a great way to verify the success of a FTP Transfer.

If you do not use FTP Transfer, and simply want to view the contents of the PCMCIA card, select this option. If any files are found, you may delete them at your option. However, it is not possible to delete individual files. If you select "Yes", all files shown will be deleted.

The file names consist of 8 hexadecimal digits with a 3 character extension. Each download results in 2 files. One is a text file containing the time and date of the download, the place (if entered), and the tail number of the aircraft if the fleet was programed. The second file is the actual download data. The text file has an extention of .txt. The download itself has an extention of .tsc. An exception to this is the Fairchild F-1000 or FA-2100 recorder which use an extention of .fdt.

Using these two options, you can minimize the time spent transferring data, thus maximizing RSU availability.

7.3 Set Date/Time

By making this selection, the RSU will lead you through a sequence of questions all relevant to the date and time. You will be asked to enter information in the following order:

Enter Year (1980-2044)
Enter Month (1-12)
Enter Day (1-31)
Enter Time (0000-2359)

To convert from AM/PM to a 24 hour format simply add 12 hours to any time after 1 PM.

If you have selected this option you will not be able to leave it without setting the time or date or reseting the RSU. You car not verify the time and date of the RSU without removing the PCMCIA card and checking the time and date of a recorded file.

The time and date feature is not important to the person using the RSU but it is very important to the individual who receives the downloaded files. If you do downlaods you want to be sure the time and date is set correctly in the RSU.

🗎 **NOTE:** When finished, press the green enter "ENT" key on the lower right of the RSU pad.

7.4 Local ZMODEM Transfer

This selection allows the transfer of downloaded data files without the need for a modem & telephone line. It utilizes a direct connection between the RSU & your PC's operating system, (using any available PC serial port). The procedure that follows assumes your workstation is running Windows 95/98/NT.

The procedure below assumes you are using the *supplied* "File Transfer" cable to connect the RSU to a known, available port on your computer. File Transfer cables are often referred to as Laplink™ cables and can be found at most computer superstores. Please call Avionica Technical Services at 305-559-9194 extension 141 if you are unsure about your cable's origin.

Before starting, ensure that no other Windows application has "captured" an available port so as to block your efforts.

Procedure for ZMODEM data transfer.

1. Create a folder to hold your downloads (e.g. "Download") on your desktop computer.

2. Connect a File Transfer cable from the 9 pin console port on the RSU (NOT the docking station) to an available serial port on the desktop computer.

3. Start Hyperterminal (Click on Start > Programs > Accessories > Communications > Hyper Terminal).

4. Enter a name for the connection (e.g. "RSU") and select an icon. (Please see figure 22 below).

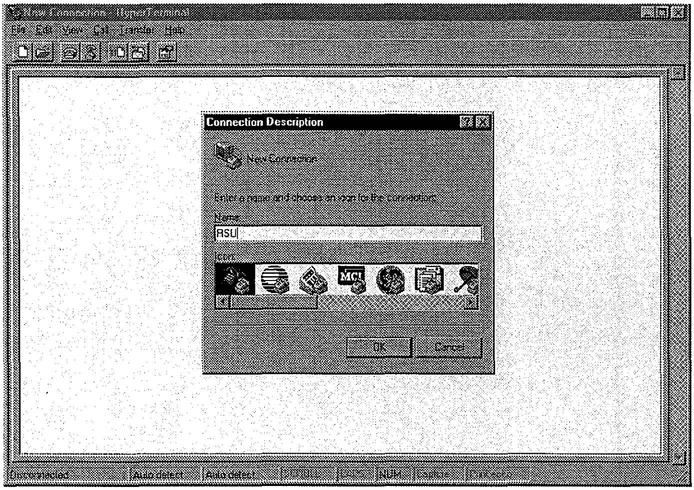


Figure 22

5. A “Phone Number” dialog box will appear. Select an available COM port. This must be the port where the File Transfer cable is attached. Click OK. (See figure 23 below).

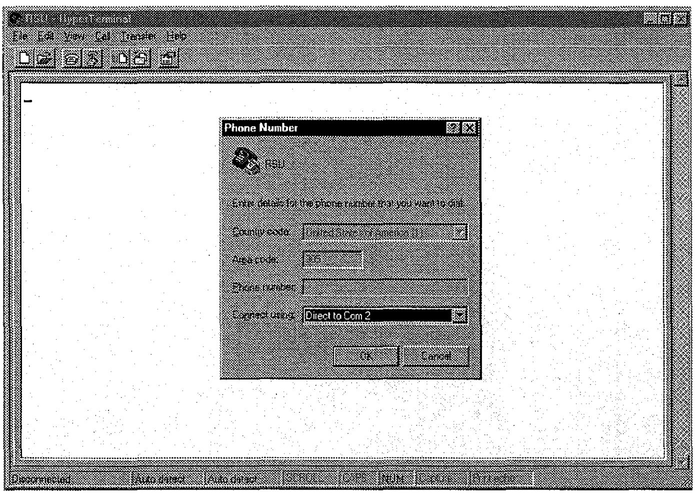


Figure 23

6. A “COMx Properties” box will appear. Select 115200 bits per second, 8 data bits, one stop bit, no parity, none for flow control. Click OK. (see figure 24 below).

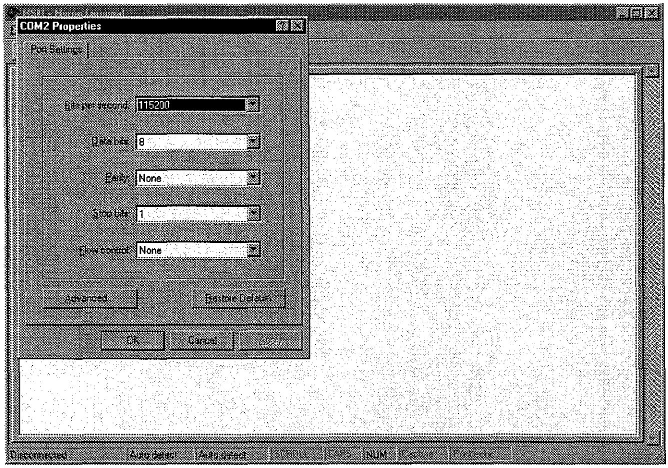


Figure 24

7. From the main menu, select transfer, receive file. Use browse to select the directory to receive the files (e.g. "Download"). Click OK to close the "Select a folder" box. Make sure that "Zmodem" is selected in the "Use receiving Protocol" box. Note that the "Receive" button is highlighted; however, this is **NOT** the desired selection in this case. Click **CLOSE** to close the "Receive File" box (see figure 25 below).

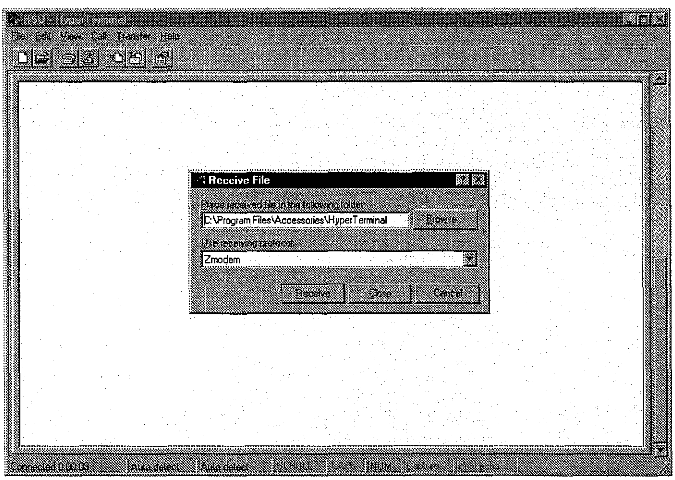


Figure 25

8. Reset RSU. Hold YELLOW button down & also hit the other three buttons on the bottom row. All must be depressed at the same time. The RSU must be reset before each transfer. Alternatively, you may tap the Avionica logo at the Main Menu, then type 911"ENT".

9. From the main RSU menu select COMMUNICATIONS.

10. Select ZMODEM transfer.

11. A box should appear on your desktop indicating transfer progress.

12. When transfer is complete, select File -> Exit (Main Menu). You will be asked if you want to disconnect. Select Yes. You will be asked if you want to save your new connection. Select Yes & it will be there for you next time.

13. The next time you wish to make a transfer you may open Hyper Terminal & the RSU connection will be there for you. Double click on it & proceed from step 6. However, you will not need to select a download directory; it will be the default.

7.5 Modem Software Update

The RSU is capable of maintaining its software revision current with minimum input from the user. To update your RSU to the most current version of the software for your particular configuration, do the following:

1. Place the RSU in the charging cradle.

2. Ensure the modem is powered and attached to an analog phone line with outside access.

3. Connect the modem to the charging cradle with the special cable provided. It has 25 pin connectors on each end and must be connected according to the labels on the connectors.

4. See figure 21. Choose the "Modem Software Update" option. The RSU will automatically dial out and retrieve the latest software image. If update does not perform properly refer to section 9.0 for a discussion of RSU configuration parameters.

NOTE: It may be necessary to manually RESET the RSU after this. To do so, remove the PCMCIA bay access cap screw with a coin, unhinge the cover, and depress the reset button. Use a ballpoint pen tip if required.

7.6 FTP Transfer

You can transfer the data that is stored on the PCMCIA card to a destination which has the resources to do the analysis. This may be done using either a network transfer or a modem transfer. All RSUs offer modem transfer. The network transfer is an option.

Modem

The modem is to be attached to the docking station's 25-pin connector. When the RSU is placed in the stand for charging, select the "Communications" option from the main menu (see left screen capture of figure 21 above). Select the "FTP Transfer" option. The modem will automatically dial, log into, and deposit all stored data files in the pre-programmed server. If the "modem transfer function" is not selected the RSU will automatically dial after it has been in the docking station for 15 minutes. If a connection cannot be established the modem will retry every 15 minutes until it makes connection. If the transfer is interrupted it will resume where it left off once connection has been reestablished. It will not retransmit from the start. When the transfer is successful the files will be erased. This may be verified by selecting "Communications" from the main menu & then selecting "Show Data To Transfer." As the data files are large, the modem transfer will take a long time (hours) to complete. For details on configuring the RSU, see chapter 9. (A PPP connection is required at the server. See Section 9.7).

Network
If you have purchased and configured the network option, you may plug into an available network port for a rapid transfer of data. The network interface cable connects to the RSU in the same manner as an FDR interface cable (to the 25-pin connector on the RSU, **NOT** the docking station) and the other end plugs into the network. The details of the transfer are the same as the modem transfer above. Details on configuring the RSU are given in chapter 9.

7.7 Calibrate Screen

If the touch screen does not respond properly it may be automatically calibrated by means of the "Calibrate Screen" option.

Select the "Calibrate Screen" option you will see a circle with center lines appear. Rotate the RSU so the writing is readable. It may be necessary to change the screen contrast to make it more readable.

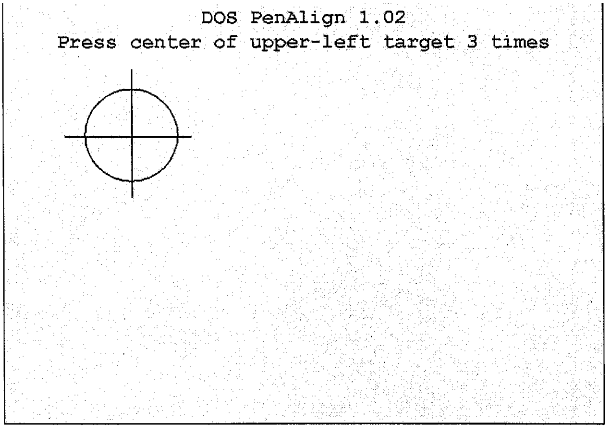


Figure 26

Press the center of the circle with the stylus 3 times. You will hear a beep each time. After 3 times (beeps) the circle will move to another corner of the screen. Again press the center 3 times. Do this for all four corners of the screen.

After the fouth corner is set the screen will switch to a “Fine-Tune Calibration” screen.

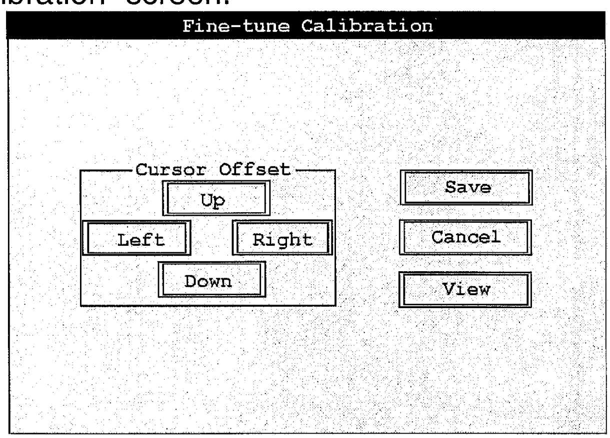


Figure 27

You will see a box labeled cursor offset (See Figure 27). Inside this box you will see labels for left, right, up, and down. Hit each one with the stylus. You may now hit the box marked “save” to save the new settings. Hitting the save or cancel label will return you to the main menu after running through a brief "DOS" screen. If you wish to see the results of the changes hit the box labeled "view".

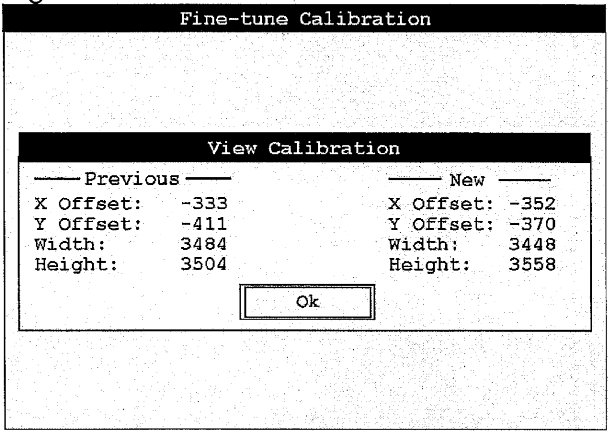


Figure 28

When through with this screen (See Figure 28) tap the "OK" button to return to the "Fine-Tune Calibration" screen.

7.8 PCMCIA Card Drive Transfer

You can remove the card from the back of the RSU by pressing the blue button next to it. You can then insert it into an internal/external PCMCIA drive & read the data as if the card were a disk drive volume. A desktop PCMCIA drive is similar to any other disk drive except that the slot is smaller. They are available from Avionica, or may be purchased from several computer superstores or mail-order houses. If you wish, you may transfer the data to a Notebook PC for analysis; most current production notebooks are factory-equipped with PCMCIA card drives.

Regardless of whether you use a PCMCIA card drive in a notebook or Desktop, ensure your PCMCIA card drivers are set to read ATA PC-Cards. If these drivers are not enabled, access will be denied (the card may not be recognized, as evidenced by a beep, when inserted).

8.0 CONFIGURING RSU COMMUNICATIONS

The RSU is an extremely flexible communications device. All communication settings (for Modem FTP transfers, Network FTP transfers, and miniQAR transfers) may be adjusted at the console.

To best understand the reason for collecting all the data below, it's instructive to understand the RSU's design purpose.

The RSU is a data collection and communication device. As such, it can be considered a node on a network with a mission of collecting FDR and miniQAR data, then channelling each data type to an appropriate server. So, from the layperson perspective, we need to collect data on a) the identity of the RSU, the FDR data destination, and the miniQAR data destination. And since data can be sent either via telephone modem or by WAN, we need data on that as well.

To configure the RSU:

1. Get to the RSU's Main Menu

2. Next, use the stylus to double-tap directly on Avionica's black airplane logo. This will take you to a blank screen which reads "PRESS 911 [ENT] RESTART."

3. Type 411 "ENT" for the configuration menu. The screen below (Figure 29) appears.

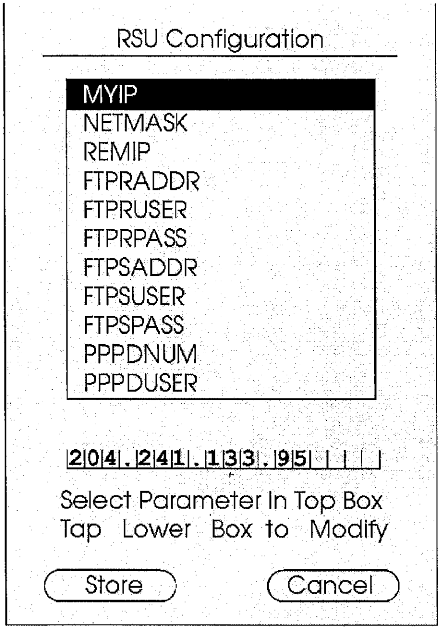


Figure 29

4. Select the entry to be changed by touching it with the stylus. The contents of each option are displayed in a field at the bottom of the screen. **NOTE:** All selections can not be seen on one screen. You must scroll to see the offscreen options. An up/down arrow in the upper or lower corner of the left side will show you which way you must scroll. To scroll touch the center of the option list with the stylus and drag it up/down until you are just outside the option list box and hold it there until scrolling has stopped. The top option is **MYIP** and the bottom option is **CUST**. If you place the stylus too low on the screen you will call up the numeric entry screen. If this happens you may clear it by hitting cancel on the onscreen keypad or simple hitting the screen above the keypad.

5. To change an entry, you may type (numeric) characters directly into the field using the keypad number and backspace keys, or you may tap the stylus in the lower (data)

field to display a touch-keyboard onscreen for alphanumeric data entry.

6. When all entries have been edited, select the **Store** option with the stylus. Your changes are permanently stored and the RSU resets.

Here's a list of all available settings. All of the settings may not be available on your unit depending on the options you purchased.

8.1 MYIP

This is the "hard" IP address assigned to the RSU if it is to be used with the Network Interface option. This value must be provided by your network administrator.

8.2 NETMASK

This is the **IP mask** to be used by the RSU if using the Network Interface option. Again, see your network administrator.

8.3 REMIP

This is the remote IP (router) address to be used if using the Network Interface option.

8.4 FTPRADDR

Those of you familiar with the Internet will recognize this as a **site address**. The RSU uses the same **File Transfer Protocol** as the Internet, and requires that an address is entered here which corresponds to the FTP address of the **remote** server that will be used for **FDR** data transfers.

8.5 FTPRUSER

This is the **Username** with which the RSU will log into the remote FTP server used for **FDR** data transfers. See your network administrator about creating a user with dialup privileges before configuring this.

8.6 FTPRPASS

This is the **Password** associated with the above user. The only privilege that the RSU user should be granted is the right to write a file on the server's FTP site. This makes the RSU user as secure as possible in terms of unauthorized login. This is the password for the **remote** server used for **FDR** data transfers.

NOTE: Your FTP Server **MUST** be set up to accommodate "DOS directory structure".

8.7 FTPQADDR

Again, this is a **site address**. The RSU uses the same **File Transfer Protocol** as the Internet, and requires that an address be entered here that corresponds to the FTP address of the server that will be used for **miniQAR** data transfer.

8.8 FTPQUSER

This is the **Username** with which the RSU will log into the FTP server used for **miniQAR** data transfer. See your network administrator about creating a user with dialup privileges before configuring this.

8.9 FTPQPASS

This is the **Password** associated with the above user. The only privilege that the RSU user should be granted is the right to write a file on the server's FTP site. This makes the RSU user as secure as possible in terms of unauthorized login. This is the password for the server used for **miniQAR** data transfer.

8.10 FTPSADDR

Again, this is a **site address**. The RSU uses the same **File Transfer Protocol** as the Internet, and requires that an address is entered here which corresponds to the FTP address of the server that will be used for **software updates.** If your configuration is managed by Avionica, leave this setting alone.

8.11 FTPSUSER

This is the **Username** with which the RSU will log into the FTP server used for **software updates**. See your network administrator about creating a user with dialup privileges before configuring this. If your configuration is managed by Avionica, leave this setting alone.

8.12 FTPSPASS

This is the **Password** associated with the above user. The only privilege that the RSU user should be granted is the right to write a file on the server's FTP site. This makes the RSU user as secure as possible in terms of unauthorized login. This is the password for the server used for **software updates**. If your configuration is managed by Avionica, leave this setting alone.

8.13 PPPDNUM

This is the **Point-to-Point Protocol** enabled **telephone number** that the RSU will dial to effect connection to the server to upload data.

8.14 PPPDUSER

This is the **Point-to-Point Protocol** dialup **username** with which the RSU will gain access to the server to upload **FDR or miniQAR** data.

8.15 PPPDPASS

This is the **Point-to-Point Protocol** dialup **password** that the RSU will use to gain access to the server to upload **FDR or miniQAR** data.

8.16 PPPSNUM

This is the **Point-to-Point Protocol** enabled **telephone number** that the RSU will dial to effect connection to the server for **software updates**.

8.17 PPPSUSER

This is the **Point-to-Point Protocol** dialup **username** with which the RSU will gain access to the server for software updates.

8.18 PPPSPASS

This is the **Point-to-Point Protocol** dialup **password** that the RSU will use to gain access to the server for **software updates**.

8.19 UPL_SRC

This is the switch which determines the **upload source** the RSU will use to gain access to the server for FTP transfer. You may use **MDM** or MODEM to select modem and **WAN** for use with the network interface.

8.20 MDM_RATE

This is the **modem rate** at which the RSU will communicate with an attached modem. The suggested setting is **38400**, for use with 33.6 and higher speed modems.

8.21 MDM_PORT

This is the **modem port address**. It **MUST** remain set at **3F8** for the RSU to communicate with a modem attached to the charging cradle.

8.22 MDM_INT

This is the **modem interrupt**. It **MUST** remain set at **4** for the RSU to communicate with a modem attached to the charging cradle.

8.23 CON_PORT

This is the **console port address**. It **MUST** remain set at **2F8** for the RSU to communicate out the rear DB-9 port with any devices designed for this interface by Avionica.

8.24 CON_INT

This is the **console port interrupt**. It **MUST** remain set at **3** for the RSU to communicate out the rear DB-9 port with any devices designed for this interface by Avionica.

8.25 CUST

This is the **Customer** abbreviation. The RSU uses this data to determine which custom configuration to load off the software update server when updating its software level.

Please note that the above modem settings must remain at their delivered settings in order for the RSU to update its software from the Avionica server.

Typical default settings for the configuration menu. Please note that your particular unit may not have all these settings.

MYIP	IP address assigned to RSU	204.241.133.95
NETMASK	IP mask to be used by the RSU	255.255.255.0
REMIP	IP address of the remote destination	204.241.133.1
FTPRADDR	FTP (IP) address used to transfer DFDR data files to	204.241.133.33
FTPRUSER	FTP user name for DFDR data transfers	ANONYMOUS
FTPRPASS	FTP password for DFDR data transfers	RSU
FTPQADDR	FTP (IP) address used to transfer QAR data files to	204.241.133.33
FTPQUSER	FTP user name for QAR data transfers	ANONYMOUS
FTPQPASS	FTP pass word for QAR data transfers	RSU
FTPSADDR	FTP address used to retrieve Software Updates from	204.241.133.33
FTPSUSER	FTP user name for Software updates	ANONYMOUS
FTPSPASS	FTP password for Software updates	RSU
PPPDNUM	PPP telephone number for modem Data Transfers	18009297084/1 3052547084
PPPDUSER	PPP user name for Data transfers	brain_trust\rsu
PPPDPASS	PPP password for Data transfers	rsu
PPPSNUM	PPP telephone number for modem Software updates	18009297084/1 3052547084
PPPSUSER	PPP user name for Software updates	brain_trust\rsu
PPPSPASS	PPP password for Software updates	rsu
UPL_SRC	Specifies "WAN" or "MDM" transfer of data files	MDM/WAN
MDM_RATE	Baud rate for modem communication	38400
MDM_PORT	Modem port address	3F8
MDM_INT	Interrupt assigned to the modem	4
CON_PORT	Console port address	2F8
CON_INT	Console port interrupt	3
CUST	Customer filename used for software Updates	Customer Specific

Figure 30

9.1 Editing Fleet Files

The fleet configuration file (ACNUM.CSV) defines the list of pre-configured aircraft and links each pre-configured aircraft to its configuration data (recorder type and conversion (.PRM) file).

The file format must be .CSV, or comma-separated value. To create or edit such a file, follow the steps below.

1. Create a spreadsheet using Microsoft Excel or similar software.

2. The first row must contain the column headings. They are: TAIL, DFDR, and PRM

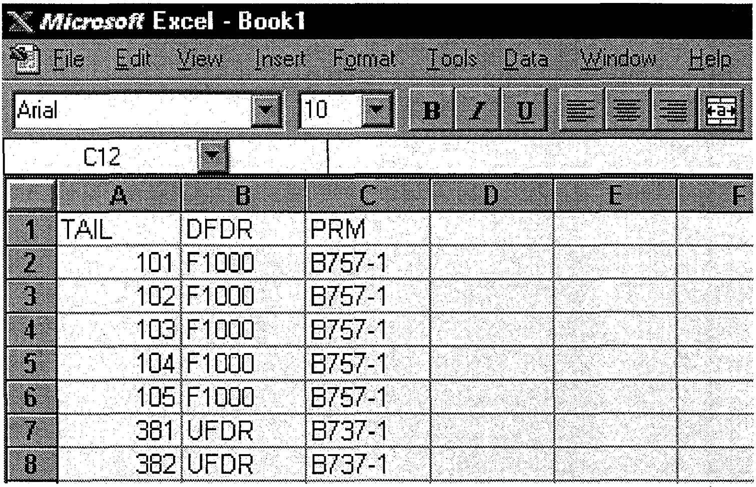
3. Each subsequent row should contain the relevant configuration on a per-aircraft basis, using the following guidelines:

i. TAIL is to be limited to four characters.
ii. DFDR is to be limited to one of the following available recorder types, assuming the user has the necessary hardware/software interface (see your RSU DFDR Selection Menu screen to determine which are loaded):

DFDR - Sundstrand 981-6009-xxxx
F800 - Fairchild/Loral 17M7xx-xxx
Fairchild/Loral 17M8xx-xxx
Fairchild/Loral 17M9xx-xxx
F1000 - Fairchild/Loral S7xx-xxxx-xx
Fairchild/Loral S8xx-xxxx-xx
FA2100 - L3 Communications 2100-4043-xxx
L209 - Lockheed 209
PV1584G- Plessey PV1584G
SCR500 - British Aerospace SCR-500

SSFDR - Allied Signal 980-4120-xxxx
Allied Signal 980-4700-xxxx
UFDR - Sundstrand 980-4100-xxxx

iii. PRM is to be limited to an 8-character filename (do NOT add the file extension here) representing the applicable conversion file for the particular tail number. ENSURE this file is available in your RSU.



	A	B	C	D	E	F
1	TAIL	DFDR	PRM			
2	101	F1000	B757-1			
3	102	F1000	B757-1			
4	103	F1000	B757-1			
5	104	F1000	B757-1			
6	105	F1000	B757-1			
7	381	UFDR	B737-1			
8	382	UFDR	B737-1			

Figure 31

4. After the spreadsheet is completed, save in “MS-DOS or OS/2 comma-separated-value, (.CSV) format”.

If you do not wish to use a spreadsheet, ANY editor or word-processor will do. Simply ensure that the first row contains the headings, and all entries on a row are separated by commas. If you use a word-processor, ensure that you save in TEXT ONLY mode. Save the file as ACNUM.CSV and follow the instructions below to load it into the RSU.

9.2 Loading File Images

Either Avionica (or your own organization) maintains a controlled image of your RSU. The image is based on your specific fleet and options purchased.

You may load images "manually", or have the RSU download them from a pre-programmed server site. The latter is discussed in Chapter 7 under "Modem Software Update". To do a manual update you will need a computer with a PCMCIA card reader. Most laptops have a card reader. To load a new image manually, you must obtain a copy of the software image self expanding executable file via e-mail, download from the Avionica FTP site, or by means of a floppy drive. The executable file will have your company name (or abreviation) followed by the extension .exe. Be careful not to double click on the self expanding executiable or you will have undesired files in the wrong places. Along with the executable file you will find an install file (install.bat) and an instruction file (RSUload.pdf). The instruction file is readable with Adobe Acrobat. Any Web browser can read it.

Before attempting a manual update it is strongly recommended that you make a copy of your existing RSU files in case you find the need to go back to them. This is particularly true if you have custom parameter files as the new image will overwrite them. If you have a ACNUM.CSV file, it will automatically be saved and replaced at the end of the upgrade.

To accomplish the upgrade place your PCMCIA card in a card reader. Copy the files "company.exe" and "install.bat" to the root of the PCMCIA card.

Select "Start|Run" from the task bar. Type in "E:\INSTALL COMPANY.EXE". "E" is the letter of the PCMCIA card and may be different on your computer. "COMPANY" is a sample name. Use your company name or abreviation instead (the name of the exe file from Avionica). Click "OK". Install the PCMCIA card in the rear slot of the RSU. From the main menu tap on the Avionica Logo. At the screen saying "Type 911 enter..." type 123 and hit the green enter key on the keyboard. When the screen stops scrolling with the message "You must now remove..." simply hit the green "Enter Key" once more.

Note: Please refer to Chapter 14.0, the Troubleshooting section for more details on resetting the RSU.

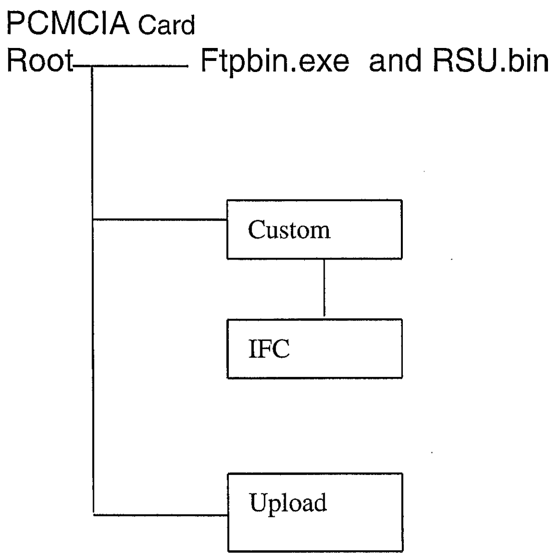
9.3 Software Arhitecture

All the RSU software is contained on the PCMCIA Flash card as shown below. Two core files (FTPBIN.EXE and RSU.BIN) are in the root directory of the card. Numerous files are contained in the custom folder including the "UpdatesText.txt' file which lists all the files for a particular RSU (except for the two core files on the root directory).

There is an "IFC" folder below the custom folder which contains the various parameter files and the PTI (cable) driver files. All parameter files and cable driver files are to be placed in the "IFC" folder. Downloads from the FDR are contained in the "UPLOAD" folder ready to be uploaded to an analysis computer. If no downloads have been made you may not see this folder. It will automatically be created when you do perform a download.

Although all the files are stored on the card many are copied into the RSU ram for execution. They are loaded into the RAM by means of a hard reset. If you do a hard reset without the PCMCIA card plugged in you will see a D> prompt on the screen instead of the main menu.

If you do a reset without the PCMCIA card in place and receive the D> and then reset again with the card installed and see the expected main menu you will have assurance of a sucessful reset and reload of the software and know that you are not still using old software which had been previously loaded into RAM.



10.0 CONNECTING THE FDR TO THE RSU.

Depending on the flight recorder make and model, you will need to use a specific interface cable to connect the flight data recorder to the RSU (Figure 32). For interface cable applications and associated Avionica part numbers, see figure 33.

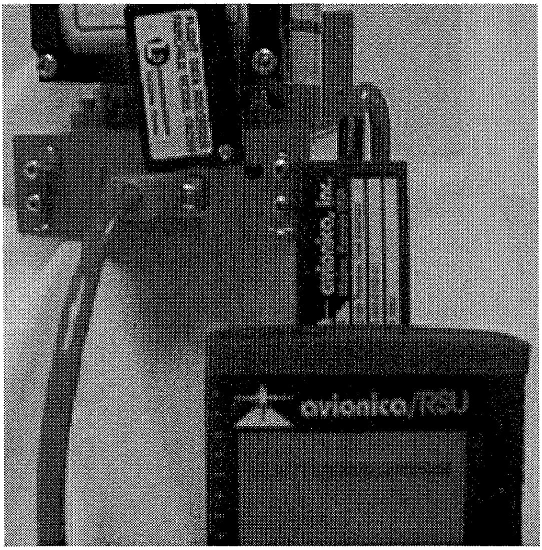


Figure 32

10.1 Interface Cable Part Number Reference

802-0130	Allied Signal UFDR Portable Test Interface
802-0146	Allied Signal SSFDR Portable Test Interface
802-0139	Allied Signal DFDR (981-6009) Portable Test Interface
802-0140	Allied Signal DFDR (981-6009) Bench Download Interface
802-0147	Allied Signal FDAMS/DMU PCMCIA Interface
802-0148	Avionica MiniQAR Portable Test Interface
802-0145	BAE Systems SCR-500 Portable Test Interface
802-0141	Embraer 120 Real-Time Portable Test Interface
802-0132	L3 F800 Hi-Speed Portable Test Interface
802-0138	L3 F1000 Portable Test Interface

802-0152	L3 FA2100 Portable Test Interface
802-0136	Lockheed 209/Plessey Portable Test Interface
802-0137	Lockheed 209 Portable Rack Adapter
802-0142	Penny & Giles 91005 Portable Test Interface
802-0143	Penney & Giles D50330 Portable Test Interface
802-0150	SFIM ESPAR Portable Test Interface

Figure 33

NOTE: The following is a typical portable FDR interface connector. Please refer to Figure 33 above, the Avionica catalog or website (www.avionica.com) for specific applications.

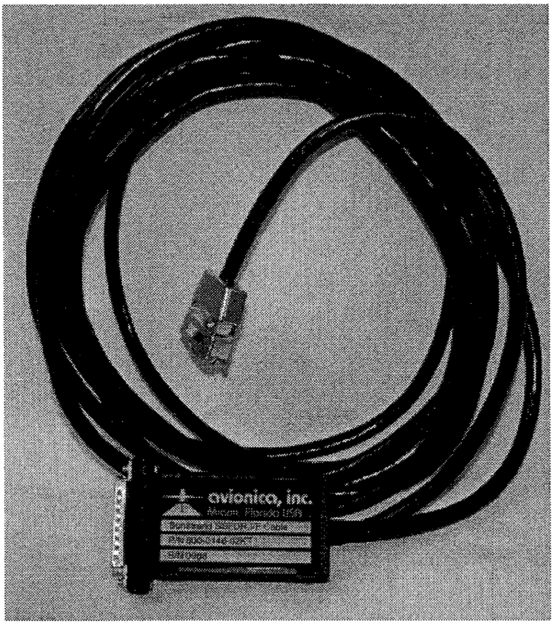


Figure 34

10.2 Available Accessories

To better accommodate individual user needs, the following are also available for your RSU.

802-0161	115 VAC, 47-400Hz Power Adapter
802-0155	Network Interface Cable 10 baseT (10 Mbit Ethernet, RJ-45)

Figure 35

11.0 DIGITAL FLIGHT DATA RECORDER DESIGN

As the name implies, these units record digital, or binary data. There are currently only three possible methods for storing binary data: Magnetic media, optical media, and solid-state semiconductor (memory). Optical media is used in some quick-access recorders. Magnetic media has been employed in tape form, and solid-state semiconductor memory is fast becoming the medium of choice for reasons described below.

There are three basic designs used in digital flight data recorders: reel-to-reel tape, single-reel (center feed) tape, and solid-state memory.

Reel-to-reel systems are serial access systems, requiring the user to patiently wait to reach the required data at a given point on the reel. Some recorders are capable of playing back data at higher speeds than their recording speed, but others are not. In a reel-to-reel system, data is written in a round robin manner to the series of numbered tracks. Data begins at the start of track 0 and proceeds to the end of the tape. The tape then reverses direction and begins writing on track 1. Speaking geometrically, the end of track 0 and the beginning of track 1 are adjacent. This back-and-forth scheme continues until the heads reach the end of the last track, the designation of which varies by recorder, then the beginning of track 0 is overwritten and the process begins anew.

In a single reel system, tape is wound on a single reel. It feeds from the center of the spool to the recording heads, then is retrieved on the outside of the same spool (much like an 8-track tape). The tape always moves in the same direction in a continuous round-robin. When the "end" of a track is reached, the heads position to write the "beginning" of the next track. All tracks start at the same position on the tape and are parallel to each other.

The typical digital flight data recorder can store about 25 hours of data at a minimum. It should be noted that the FAA permits no more than one hour of data loss from a recorder undergoing a transcription. Using the RSU menu system, the task of calculating track selection and position to accomplish this on a tape-based unit is greatly simplified.

Solid-state memory systems in today's newer recorders are random-access. Much like memory in your PC, users may quickly find exactly the data in question. Data is written to flash memory chips (flash memory does not require power to maintain its contents as RAM does) in a predetermined sequence. When the last chip(s) have been filled, the first set is overwritten. Since the recorder maintains a pointer to the current memory position at all times, the user may easily specify the point in memory to access and how much information should be extracted. Additional benefits include high speed access not limited by motor speed or gear mechanisms as well as a much better signal since data is not converted from digital to analog media and back again. The result is a faster, more reliable transcription.

12.0 SUPPORTED DFDR, CVR, QAR UNITS

This section describes individual operational characteristics of the most popular recorders in the Western hemisphere. Many more recorders, FDAUs, and other devices than those mentioned are supported, but their operational characteristic are similar to one or more of the units described below.

12.1 Sundstrand UFDR (980-4100-XXXX)

It should be noted that Allied-Signal has purchased the flight data recorder division of Sundstrand, yet the name Sundstrand will be used throughout this text to differentiate these older tape-based units from Allied's new solid-state flight data recorders.

The Sundstrand UFDR is a reel-to-reel magnetic tape based unit. Each end of the tape has a clear splice that triggers an optical sensor to reverse the tape direction. The tape has eight tracks, four traveling in each direction. The tape transport is driven by a digital stepper motor, capable of precise motion.

The UFDR writes data to tape using a novel operation Sundstrand calls a "checkstroke." While ARINC standard 573 requires a 768 bit-per-second data rate, the Sundstrand tape mechanism is capable of recording 11.4 kilobits per second. The additional bandwidth is used to perform the aforementioned "checkstroke," or read-after-write process. When the recorder receives a 768-bit data frame, it backs up over the previous frame, verifies it with data stored in a memory buffer, and then advances the tape to write the new frame. The entire operation is performed in a fraction of a second, the tape being precisely accelerated and decelerated by the stepper motor mechanism. The data-encoding format is standard Harvard Biphase.

There are several transport controls available. In addition to track change, which increments the currently selected track by one, there are **run forward** (high speed playback in the same direction as data on the current track), **run reverse** (high speed playback in the opposite direction to the data on the current track), **fast forward** (high speed to the end of tape referencing track 0) and **fast rewind** (high speed rewind to the beginning of the tape referencing track 0).

Another useful feature is known as **write tone**. When in the record mode, the recorder will write a 2.5 KHz tone to the tape, a pattern never encountered in normal data. Using the corresponding **tone detect** feature, which places the recorder in standby mode when a tone sequence is detected, the same position may be found after ground operations for tape positioning. Track change controls also exist for track positioning as necessary.

The Sundstrand UFDR is capable of playback at 11.4 kilobits per second. Reading a single track at a time at this rate, Avionica equipment can accomplish a 25 hour readout in less than 2 hours. In this mode, the Sundstrand delivers its readout data as a digital ARINC-573 signal.

NOTE: Any of the Sundstrand 980-4100 Series tape-based recorders may be read using the UFDR driver from the RSU's FDR select menu.

12.2 Loral/Fairchild F800

The F800 is unusual in that it is a single reel (endless-loop) magnetic tape based unit. The tape is roughly 458 feet long and repeats itself every four hours and 13 minutes, feeding from the inside of the reel and taking up on the outside. There is a half-inch window in the tape which triggers an optical track-change sensor to switch from one track to another. Sequencing through the six tracks results in over 25 hours of unrepeated recording. The tape transport is driven by a 115V, 400Hz two-phase induction motor.

The F800 supports both the ARINC-542A and ARINC-573 data standards. The 542A format consists of 32 12-bit words per one-second subframe, whereas the 573 format consists of 64 12-bit words per one-second subframe.

NOTE: An F-800 using the 542A standard requires selection of the F800-2 interface driver from the RSU's FDR select menu.

When recording in ARINC-573 mode, however, the F800 doesn't encode the data as Harvard Biphase - it has insufficient bandwidth. Instead, Loral retrofitted their existing design with new software, encoding the data in a format known as GCR (group code recording). This format requires fewer level transitions (lower bandwidth) to represent the same data.

NOTE: An F-800 using the 573 standard requires selection of the F800 interface driver from the RSU's FDR select menu.

Unfortunately, timing becomes a more critical factor in such a design, and the F800's two-phase induction motor transport design is marginal. A common problem with these units is "jitter" introduced into the transport speed by vibration. For this reason, all flight recorder shock mounts should be carefully inspected whenever a transcription is performed.

An additional disadvantage inherent in this design is that playback proceeds at the same rate as recording. As a result, a complete transcription of this recorder type takes 4.5 hours. Avionica's software is programmed to transcribe all 6 complete tracks at once, then splice them together in proper order. As a result of the multiple-track read and splicing scheme, partial readouts are not possible (data continuity would be compromised). The F800 does not provide its readout data in digital form. Instead, a sophisticated equalization / amplification and analog to digital converter circuit housed in the interface cable is employed to convert the analog output to a format readable by the RSU.

The F800 provides some basic tape transport management functions, such as **Track Change** (increments the selected tape transport track sequentially from zero through five). **Data Enable** (enables the F800 to record data to tape), and **Record Enable** (Stops the incoming data stream, causes a blank pattern to be written to the tape).

12.3 Lockheed 209

Like the Sundstrand UFDR, the Lockheed 209 is a reel-to-reel tape-based unit. The Lockheed does not employ any unusual writing or encoding designs. Each tape end includes a transparent film that triggers a track change sensor to reverse direction and change tracks. There are six tracks, each just over four hours long.

Like the Fairchild unit, however, the Lockheed does not provide digital, but analog, data for transcription purposes. The Lockheed interface cable thus also implements a sophisticated equalization/amplification and analog-to-digital converter to make data useful to the RSU.

The Lockheed unit does have a high speed playback mode, and Avionica's RSU interface utilizes this capability to read the tracks in two passes of three tracks, then splices them together in proper order. A complete readout may be accomplished in under 20 minutes. As a result of the multiple-track read and splicing scheme, partial readouts are not possible (data continuity would be compromised).

A peculiarity of the Lockheed unit is that it has no front connector. Realizing the limitations, Lockheed eventually provided designs for a breakout connector to be mounted at a remote location in the airframe. The RSU interfaces are designed to attach to this connector type. It is conceivable that you will encounter a Lockheed installation without such a breakout connector. For such instances, Avionica provides a rack adapter interface harness, which mounts between the recorder and the rack and permits mating to our standard harness.

NOTE: Two possible drivers are avaliable for the L-209: The L209 or the newer L209e. Which one is correct for you depends on the revision of your interface cable. Look at your L-209 PTI and note the revision level. If it is a revision e your will need to select L-209e at the FDR screen. If it is an earlier version, L-209 will be the proper selection.

12.4 Fairchild F-1000

This was the first fully solid-state digital flight data recorder supported by Avionica. Data is recorded onto flash memory chips. Flash memory, as mentioned before, is unlike conventional memory in that it retains its data without need of power.

The F-1000 writes to its memory filling a pair of chips at a time. In order to maximize reliability in the instance of a failed chip, the F-1000 writes to chip pairs in alternating sequence. Unlike the reel-to-reel recorders covered so far, this unit only writes to its media every four seconds, writing all four sub-frames (or one data frame) at once. Four seconds of data are written to one chip, four more to the second in the pair, then back to the first until the pair is filled. The process continues, filling memory pair by pair until all memory is filled. The F-1000 can record well over 25 hours of data before overwriting any of its memory. Each chip is serialized, so at any point in time the unit may be queried to transcribe the last x flight hours of data.

Due to the high cost of memory when this unit was designed, Loral implemented a data compression scheme into the recording process. Avionica's software figures the proper chip set and order and produces a bit-for-bit copy of the compressed data file format (.FDT) which is fully compatible with that specified by Loral. These files may be used interchangeably with the Loral GS/2 equipment.

Though the F-1000 reads data from the ARINC-573 databus, and is available with "doghouse" mounted sensors of its own, it produces readout data in RS-422 format instead. This is a departure from common aviation practice, and is probably a sign of things to come, as avionics equipment becomes more compatible with PC-based test equipment.

The F-1000 closely follows the standard RS-422 bi-directional packet architecture, known commonly as SDLC (serial data link control). This packet architecture consists of a synchronization signal, followed by the packet length to be sent and a 2-byte CRC (Cyclical Redundancy Check), then the actual data packet and another CRC for it. The receiving unit checks the data against the CRC then, based on the results, transmits an acknowledgment packet or an error packet back to the transmitting unit, so that either the next packet may be transmitted or the previous packet repeated.

Though this process may seem cumbersome, it is very efficient and reliable. On a PC with a high speed serial port (16550 UART required), an entire 25 hours of flight data may be transcribed in about 10 minutes!

As a result of the proprietary compression, resulting data files (.FDT) must also be decompressed using the Fairchild (L3 Communications) decompression utility (SADECP.EXE), before the data may be processed into usable form. Avionica AVSCAN.flight and AVSCAN.fleet software can automatically decompress these files. If you aren't using AVSCAN, Avionica will provides L3's decompression utility for your use on our web site as the file SADECP.ZIP.

NOTE: An F1000 requires selection of the F1000 interface driver from the RSU's FDR select menu.

12.5 Allied Signal SSFDR (980- 4120, 980 - 4700)

Like the F1000, the Allied-Signal SSFDR records data to flash memory chips. The maintenance interface, located on the front of the recorder, provides a direct connection to the incoming Harvard Biphase signal for real time monitoring as well as a serial download connection (though the RSU interface does NOT use the Harvard Biphase signal, but the RS-422 instead). The download connection is made through a standard asynchronous interface; electrical connection is standard RS-422. The SSFDR implements only complete download facility.

NOTE: An SSFDR requires selection of the SSFDR interface driver from the RSU's FDR select menu.

12.6 British Aerospace SCR - 500

The SCR-500 is a combined data and voice recorder. A single processor coordinates the reading of 4 analog audio channels (Cockpit area microphone and 3 communications channels), the digital flight data, and storing all the data in flash memory chips. The SCR-500 memory module can contain up to 48 memory chips. Each chip is allocated to one of the channels (audio or flight data). Audio recording generally requires more storage, as such, the majority of the chips are allocated for the 4 audio channels.

The maintenance interface, located on the front of the recorder, provides a direct connection to the incoming Harvard Biphase signal for real time monitoring as well as a serial download connection. The download connection is made through a standard synchronous interface, electrical connection is standard RS-422. The download connection also permits diagnostic and analog audio replay functionality.

12.7 Miscellaneous FDAU Monitoring

Avionica provides a number of off-the-shelf interfaces to accomplish real-time monitoring of FDAU data, either directly from the FDAU-mounted test connector or from a remotely mounted connector conforming to an airframer's specification.

The majority of the Teledyne FDAU & DFDMU product lines are covered, as are the test connectors of most Boeing and Embraer aircraft. See our web site for the most recent additions.

Note: Do not attempt to use the "Read DFDR Data" option in conjunction with a real-time only interface such as an FDAU monitoring interface. The process will fail.

When monitoring data in real-time, and more specifically when viewing it in engineering units, the specific aircraft configuration is important. The FDAU configurations of a particular airframe are typically unique, like the instruments and transducers themselves. To further complicate matters, like data may appear in different word-frame and bit positions. For this reason, Avionica has established and continuously updates a growing library of *parameter files*. These files contain the equations necessary to translate the raw octal data in each word into meaningful engineering units.

See our web site or call Avionica to inquire about revision service and insure you're aware of our complete selection of parameter files.

In most cases, purchasing a parameter file from our library, or even requesting a custom file, will be much more cost-effective than generating it yourself.

For those cases where having Avionica generate a file is not an option, we present the format and considerations for editing or building one below.

13.1 File format

```
<parameter definition> <cr><lf>
<parameter definition> <cr><lf>
<parameter definition> <cr><lf>
.
.
<parameter definition> <cr><lf>
<eof>
```

where <cr><lf> indicates a carriage-return & line feed combination and <parameter definition> is composed of the following fields:

parameter position, sub-frame, shift, mask, slope, intercept, parameter name, engineering units, function, decimal places, miscellaneous

NOTE: As indicated above, all elements of the parameter definition must be on a *single* line! The following excerpt illustrates:

```
10,0xf,0,0xfff,.002289,-3.375,Vert_acc_2,g,lin_func_2,2,~
18,0xf,0,0xfff,.002289,-3.375,Vert_acc_3,g,lin_func_2,2,~
26,0xf,0,0xfff,.002289,-3.375,Vert_acc_4,g,lin_func_2,2,~
34,0xf,0,0xfff,.002289,-3.375,Vert_acc_5,g,lin_func_2,2,~
42,0xf,0,0xfff,.002289,-3.375,Vert_acc_6,g,lin_func_2,2,~
50,0xf,0,0xfff,.002289,-3.375,Vert_acc_7,g,lin_func_2,2,~
58,0xf,0,0xfff,.002289,-3.375,Vert_acc_8,g,lin_func_2,2,~
20,0xf,0,0xfff,.0005086,-1.083,Long_acc_2,g,lin_func_2,2,~
52,0xf,0,0xfff,.0005086,-1.083,Long_acc_3,g,lin_func_2,2,~
```

Definitions for the specific field elements are as follows:

13.2 Parameter Position (Word Slot)

The decimal offset of the particular parameter from the beginning of the sub-frame is its position. The first parameter in a sub-frame is 1. If a word number has only one digit, preface it with a blank, not a 0. A 0 will cause the number to be interpreted as an octal value.

13.3 Sub-frame

This is defined as the (hexadecimal) number resulting from the operation **2**subframe-1,** where **subframe** is the number of the sub-frame containing the desired parameter. Valid values are 0x1, 0x2, 0x4, or 0x8 for sub-frames 1, 2, 3, and 4 respectively. Logical OR-ing of any combination is also acceptable. So if the data is present in all sub-frames, the proper representation is 0xf, if in 1 and 3, then 0x5, and if in 2 and 4, 0xa.

13.4 Shift

This is the number of bit positions to shift the data in a parameter position; left is (-), right is (+). To better explain shifting, we will present a brief discussion at this point:

Engineering Unit Conversion (EUC) documents typically list multipliers (A1 coefficients) assuming that the Least Significant Bit of the data word is in bit 0. This often requires a shift, such as in cases where discretes occupy the 1st 2 bits of a word, and analog or digital data the balance.

A 2-bit binary shift to the right (i.e. moving data in bits 12-3 into bits 10-1) has the same effect as dividing the data by 4. In binary arithmetic, each digit (order of magnitude) shift represents a factor of 2, much like an order of magnitude shift in the decimal system is a factor of 10. Shifts to the right (positive by convention) divide, those to the left (negative by convention) multiply. That's why knowing where the EUC document expects the data to be found is so important.

In the case of data whose range encompasses both + and - values (such as an aileron position), the sign is often encoded into bit 12. To do signed arithmetic on a PC, however, the sign bit MUST end up in bit 16. Though it is not explicitly noted, the octal words in GP-573 are stored as 16-bit words, thus a shift of -4 is possible, and necessary for a sign bit to be recognized as such. In these cases, the mask (see below) for a 12-bit word would be 0xfff0. Since the multiplier expects data in the LSB, it would have to be dividec by 2**4=16 in order to compensate for the multiplication by 16 on the data which occurred during its necessary shift.

Once the shift is determined, and the data is in its intended position, mask as appropriate.

13.5 Masking

Masking a bit position is the logical operation of ANDing two bits together. Briefly,

1 AND 1 = 1
1 AND 0 = 0

Thus, if a bit position in a masking string is 1, the data in that position is preserved, else it is ignored (1 AND 0 = 0).

Effects of Masking an Octal ARINC 573 Word

An octal 573 word has 12 bit positions. Assuming we'd like to mask all 12 (i.e. data exists in positions 12-1) we must supply a value of 12 ones, or "fff". Here's a table for the balance of posibilities:

Data Bits:	Binary Mask	Hexadecimal Mask
12-1	1111 1111 1111	fff
11-1	0111 1111 1111	7ff
10-1	0011 1111 1111	3ff
9-1	0001 1111 1111	1ff
8-1	0000 1111 1111	0ff
7-1	0000 0111 1111	07f
6-1	0000 0011 1111	03f
5-1	0000 0001 1111	01f
4-1	0000 0000 1111	00f
3-1	0000 0000 0111	007
2-1	0000 0000 0011	003
1	0000 0000 0001	001

Data Bits:	Binary Mask	Hexadecimal Mask
16-5	1111 1111 1111 0000	fff0
16-6	1111 1111 1110 0000	ffe0
16-7	1111 1111 1100 0000	ffc0

16-8	1111 1111 1000 0000	ff80
16-9	1111 1111 0000 0000	ff00
16-10	1111 1110 0000 0000	fe00
16-11	1111 1100 0000 0000	fc00
16-12	1111 1000 0000 0000	f800
16-13	1111 0000 0000 0000	f000
16-14	1110 0000 0000 0000	e000
16-15	1100 0000 0000 0000	c000
16	1000 0000 0000 0000	8000

13.6 Slope (A1)

The floating point factor relating the octal representation of a parameter to its engineering unit representation. In the segment below, the octal representation must be multiplied by 0.0005086 to yield the longitudinal acceleration in units of g's.

13.7 Intercept (A0)

The floating point value which is a continuous offset (difference) from the computed value. In the segment below, the intercept is -1.083.

```
4,0xf,0,0xfff,.0005086,-1.083,Long_acc_1,g,lin_func_2,2,~
20,0xf,0,0xfff,.0005086,-1.083,Long_acc_2,g,lin_func_2,2,~
52,0xf,0,0xfff,.0005086,-1.083,Long_acc_3,g,lin_func_2,2,~
```

13.8 Parameter Name (Mnemonic)

The name of the parameter in question. Please note that in cases of multiple instances of a parameter within a sub-frame or even a frame, all must carry different names in order to be usefully displayed.

Parameter naming convention must be held to within 11 characters to be useful in the dBase file format, so keep this in mind if that's a consideration.

Per industry/regulatory guidelines, we suggest creating parameter categories. We use capitals for the category characters, then lower case for refinement.

Example: If the parameter in question is roll, try “ATT” (attitude) for the category, then “roll” for the parameter. If there are multiple occurrences of a parameter, occurrences after the first should be suffixed with an underscore and number, e.g. ATTroll_2. We suggest using the following categories at a minimum:

ACC	Acceleration parameters
ALT	Altitude Parameters
AOA	Angle of attack parameters
AP	Autopilot system parameters
ATT	Aircraft attitiude parameters
BRK	Brake system parameters
CTL	Control (Pilot Input) parameters
ENG	Engine parameters
GEAR	Landing gear parameters
HDG	Heading
HYD	Hydraulic system parameters
IAS	Indicated Airspeed
NAV	Navigational parameters
PTT	Mic key (push-to-talk) of radio parameters
SFC	Control surface parameters
WRN	Warning parameters

13.9 Engineering Units

The engineering units applicable to a particular parameter (e.g. degrees, g's, feet, knots, etc.). Units should be limited to 8 characters and may not contain any blanks.

13.10 Function

One of the function names which is applicable as defined below:

13.10.1 lin_func

linear function to be used when intercept is defined as added to raw octal data *prior to* multiplication by slope.

```
11,0xf,0,0xffc,9.8470e-2,01900,AOA,deg,lin_func,2,~
```

13.10.2 lin_func_2

linear function to be used when intercept is defined as added to raw octal data *after* multiplication by slope.

```
38,0x5,0,0xffc,2.6860e-2,0.0000e+0,ENG1_nl,%,lin_func_2,1,~
```

Signed Binary (Two's Complement) Parameters deserve attention as special cases of the linear functions. The sign bit must be shifted from the 12th bit to the 16th bit (might also be in another bit location, but that is unusual). This is accomplished using a negative shift.

To figure out the shift and required operations on resolution, perform the following steps: (for our example we will use a word stored in word 32, bits 12-3, resolution of 0.25, and total range of +/- 128.

Encode Without Sign: Note the required shift places to the right to get the LSB of the data in the LSB of the word.For example assume the word was found in bits 12-3. Then the shift would be 2 (right).

Make Sign Bit Work: Note the required number of places to shift the data to the LEFT to get the sign bit in the MSB of a 16-bit word. In our example, we must now shift the data -6 places (left) to get the sign bit into the MSB of the 16-bit computer word. The net shift to be entered in the PRM file is thus -6+2=-4.

Turn the Resolution into a Multiplier: The Resolution, when given, is the value of the LSB in the 12-bit DFDR word. This must be converted into a multiplier for a 16-bit computer word. Since the data was shifted to the left 6 places from the position used to calculate a Resolution, we must divide to generate a mutliplier. Shifting to the left 6 places is equivalent to dividing by 2**6. This is more convenient for performing decimal math. In our example the resolution of 0.25 translates to a multiplier of 3.90625e-3.

Calculate the required mask for the data when it is shifted to this position within a 16-bit word. In the example above, this would be 0xffc0. See Masking.

13.10.3 bcd_func

numeric conversion function to be used when raw octal data must be converted to bcd format. Use with intercept = 0 and slope = 1.

```
37,0x4,0,0xf,1.0000e+0,0.0000e+0,GMThours,hrs,bcd_func,0,~
```

13.10.4 octal_func

numeric conversion function to be used when raw octal data must simply passed through. Use with intercept = 0 and slope = 1.

```
37,0xf,0,0xfff,1.0000e+0,0.0000e+0,WORD37,,octal_func,0,~
```

13.10.5 binary_func

numeric conversion function to be used when raw octal data must simply be converted to binary format. This function is limited to showing 4 bits. Use with intercept = 0 and slope = 1.

```
32,0x4,0,0xf,1.0000e+0,0.0000e+0,STATbits,,binary_func,0,~
```

13.10.6 synchro_180_func

numeric conversion function to be used when raw octal data must be interpreted as TELEDYNE syncho position between -180 degrees and +180 degrees. Use is typically with intercept = 0 and slope = 1, but may be scaled, in which case the slope and offset are applied as per **lin_func_2**.

```
20,0xf,0,0xfff,1,0,ATTpitch,deg,synchro_180_func,1,~
```

NOTE: DO NOT SHIFT. If necessary mask off lower bits. Any shift will have detrimental effect on the multiplier provided for the synchro function, as well as the sign bit.

13.10.7 synchro_func

numeric conversion function to be used when raw octal data must be interpreted as TELEDYNE syncho position between 0 degrees and +360 degrees. Use is typically with intercept = 0 and slope = 1, but may be scaled, in which case the slope and offset are applied as per **lin_func_2**.

```
3,0xf,0,0xffc,1,0,HDG,deg,synchro_func,0,~
```

NOTE: DO NOT SHIFT. If necessary mask off lower bits. Any shift will have detrimental effect on the multiplier provided for the synchro function, as well as the sign bit.

13.10.8 inter_func

linear interpolation function. This is function makes use of the misc field defined below. Use with an intercept of 0 and a slope of 1. In the misc field, place a minimum of two data points with the following format:

octal value/engineering unit equivalent

You may enter as many sets as required, but must maintain a line length under 255 characters. Additionally, data sets must progress from low to high values and must end with a data set with 7777 as the maximum octal value (high range limit). See the excerpt below:

```
15,0xf,0,0xfff,1,0,SFCelev,Deg,inter_func,2,1605/-17 7777/60
```

13.10.9 inter_func_2

linear interpolation function. This function makes use of the misc field defined below. Use with an intercept of 0 and a slope of 1. In the misc field, place a minimum of two data points with the following format:

decimal value/engineering equivalent

You may enter as many sets as required, but must maintain a line length under 255 characters. Additionally, data sets must progress from low to high values and must end with a data set with 4095 as the maximum integer value (high range limit). See the excerpt below:

```
15,0xf,0,0xfff,1,0,SFCelev,Deg,inter_func,2,800/-17 4095/60
```

13.10.10 null_func

special function for permitting concatenated data and super-frame operation.

13.10.11 Misc.

A field reserved for special additional parameters called for by specific functions, such as inter_func and inter_func_2 described above.

13.11 Concatenated words

When data fields are larger than 12 bits, they are stored in more than one word/frame location. If a single parameter is split across multiple words, and the logical OR of the two is the required datum, then use the null_func for the second word, immediately after the first word, and the two will be ORed. The second word is not to have any parameter name.

```
23,0x1,-11, 0xf800,2,0,ALT,Ft,lin_func,0,~
 5,0xf,  1,  0x7ff,1,0, , ,null_func,0,~
```

Proper shifting is critical to achieve the correct logical OR. there is a maximum of 16 bits available to store the data from the two words. If precision exceeds 16 bits, the words will have to be treated separately (as a computed parameter) or the LSBs may be truncated, resulting in a loss of precision.

13.13 Super-frame words

When data fields occur less frequently than once per frame, a super-frame qualifier can be used. The qualifier immediately follows the parameter definition and acts to refresh the parameter whenever the qualifier condition is met. The "condition" is the value of the current superframe cycle, a number between 0 and 15 (There are typically 16 cycles in a superframe).

The qualifier is formed when a pseudo-definition line is added immediately after the parameter definition line to be qualified, where:

The conversion function is set to null_func
The frame and sub-frame are set to 0
Shift is set to –1
The mask is set to the desired qualifier (typ. cycle count-1)
The parameter name is set to match another parameter in the definition file to be used as the qualifier data source (e.g. "SF"). This is the parameter designated as the "superframe counter" in the OEM's applicable documentation.

The qualifier data source is defined elsewhere in the file (usually at the top) using the standard means (lin_func is fine for this). A superframe is distinguished from a concatenated definition, which is similar in form, because a concatenated definition always has a non-zero sub-frame value. Think of the qualifier as a temporal, or time mask, whereby the data is only defined in the stated cycle.

```
Example:

57,0x2, 0,    0xf, 1.0000e+0, 0.0000e+0, sf,,lin_func_2,0,~
57,0x1,-4,0xfff0, 2.5000e+0, 0,APaltsel,Ft,lin_func_2,0,~
 0,  0,-1,     4, 0.0000e+0, 0.0000e+0, sf,, null_func,0,~
```

13.14 Testing your formulas

To test your formula, you may run the parameter file against the TEST.TSC file, which Avionica can provide upon request, and ensure that the range & profile matches that declared within the aircraft documentation. TEST64.TSC is a 64 Word per Sub-frame data file, with data for ALL words in the 1st subframe =0, 2nd subframe =1 counting up linearly through the 4095th subframe to 7777 octal. TEST128.TSC is a 128 Word per Sub-frame data file, structured as described above, and TEST256.TSC is a 256 Word per Sub-frame data file, structured as described above.

Please note that superframe and concatenated parameters will fail in this type of test file. They require real data for testing purposes.

Although the RSU is an extremely reliable device there may be times when some help will be needed. Some of the more common questions that have been asked are listed below. If the help you need is not found here please check the Frequently Asked Questions (FAQ) section of our Web site (www.avionica.com). This site will be continuously updated as new information becomes available. If the answer to your question can not be found in the manual or on the Web please call Avionica Technical Support at: ☎(305) 559-9194 ext 141 or send E-mail to: sales@avionica.com.

14.1 DOS Screen

The RSU boots up with a DOS screen instead of the main menu. It will be necessary to reset the unit by simultaneously pressing all 4 buttons on the bottom row.

You may also try a hard reset by pressing the small reset button inside the removable top cover.

If this does not work consult the amplified reset instructions starting at step 8 of section 14.6.

This situation sometimes occurs when the battery charge is low.

14.2 Blank Screen

Try resetting the unit with the reset switch inside the top cover as described in section 14.6.

14.3 Cannot read real time data

A parameter file is always required to read real time data. If you do not have .prm files for your aircraft you must select OCTAL64SFS, OCTAL128, or OCTAL256. Currently, 64 word per second recorders are the most common and OCTAL64SFS would probably be the file you need. It is also very important to insure proper seating of the interface cable. Be sure that the cable is locked in place by engaging the lock on the RSU connector.

14.4 Cannot download

Be certain that the interface cable is connected before power is applied to the flight data recorder. Power the recorder when prompted by the RSU.

Also be certain to lock the cable connection to the RSU.

14.5 Battery does not hold charge

Be certain that the RSU has been in the docking station long enough for the charge indicator light to switch from red to green.

14.6 Flash card has become corrupted

If you have lost your software completely you will find a copy on Avionica's FTP site. The necessary files to rebuild your RSU will be in your company folder at FTP://avionica.com. They are RSU.EXE and COMPANY.EXE. In this case, COMPANY is your company name. The .EXE files are self extracting files.

1. Download the files to a working directory & log on to that directory.
2. Place the PCMCIA card (Hard Drive) in the desktop computer.
3. Make a folder called \CUSTOM on the PCMCIA card.
4. Switch to a DOS prompt.
5. Type RSU X:, where X is the PCMCIA drive letter will load the core software.
6. Type MD X:\CUSTOM.

7. Type COMPANY –D X:\CUSTOM This will load your interface drivers & parameter files.
8. Remove the card (drive) from the desktop computer. Do not plug it into the RSU.
9. Reset the RSU using the pin-switch under the card cover.

10. When the RSU beeps 2 times, press the I/O switch for 1 second.
11. You will be prompted to press 4 to boot from the PCMCIA card (drive). Do not press it yet.
12. NOW, insert the PCMCIA card (drive) into the lower (back) slot of the RSU.
13. NOW, press the 4 key.
14. The RSU will boot from the PCMCIA card.
15. When you are prompted to "Remove and Reinsert...", simply press the Green ENT key.
16. The main menu will appear.
17. Set the Date.
18. Press the Logo (Airplane taking off) and type 411"ENT".
19. Ensure your settings are correct, and change as necessary.
20. Click Store.

14.7 Touch Screen does not work

At times the RSU screen calibration shifts.If touching the screen at the proper point does not produce a response try touching nearby areas. Recalibrate using the procedure in Section 7.7.

14.8 Hard reset

When other reset techniques do not work the following may prove effective:

1. Remove the PCMCIA card (drive) from the RSU computer.This may be done with power on or off.
2. Reset the RSU using the pin-switch under the card cover.

3. When the RSU beeps twice, press the I/O switch for 1 second.
4. You will be prompted to press 4 to boot from the PCMCIA card (drive). Do not press it yet.
5. NOW, insert the PCMCIA card (drive) into the lower (back) slot of the RSU.
6. NOW, press the 4 key.
7. The RSU will boot from the PCMCIA card.
8. When you are prompted to "Remove and Reinsert...", simply press the Green ENT key.
9. The main menu will appear.
10. Set the Date.

14.9 I Removed the PCMCIA Flash Memory Card; which slot does it go in?

The PCMCIA card belongs in the back (lower) slot of the computer. The contacts face toward the computer. The card will only plug in one way. It can not be plugged in backwards. However, it will only work if it is in the proper slot. The card may be removed and replaced with the power on.

14.10 RSU beeps and will not turn off

Remove top and press reset switch. Perform hard reset as per 14.8. Check state of charge of battery.

14.11 RSU does not respond to I/O switch.

Same as 14.10.