

TROTTER CONTROLS FORT WORTH, TEXAS	PROCESS SPECIFICATION		NUMBER	REVISION
	REPORT ORDER		PS-0035	B
TITLE GEN II FRDS Memory Management	BY	CHK'D	MODEL	
	LA / MP / JF	CG	GEN II FRDS	
	DATE	REV. DATE	SERIAL	
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Overview

This document covers the memory management within the GEN II FRDS unit. This includes:

- Replacing a damaged pilot interface
- One that has possibly been corrupted or inadvertently modified

This document does not cover the removal or installation of the pilot interface or connections to it.

Not properly following the directions laid out in this manual can cause erroneous operation of the FRDS unit including corruption of leakage tables and data calibration loss. This can result in a complete failure of Auto and Timer functions requiring operation in Manual Mode only.

References

Item	Document	Company
1	ER-0074 FRDS GEN2 SYSTEM OPERATION PARAMETERS (TWEAKS)	Trotter Controls Inc.

Revisions

REV	Changes made
B	Added section for EEPROM out of date recovery and Revision header

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Memory Types and Organization

The FRDS Gen II system contains FOUR independent copies of EEPROM (electrically-erasable programmable read-only memory) that are used to save data (parameters, leakage table, analog calibration values, etc.) in an area that will be maintained across power-cycle events.

Each of the four independent banks of saved EEPROM memory contain a 16-bit checksum to insure that all data read from the bank of memory is intact and not corrupted. Any errors encountered while reading any bank of memory are detected and reported, allowing for corrective action.

Two of the memory banks reside on the PIC ds30 microprocessor chip (which resides on the “core” board inside the Pilot Interface). These two memory banks are referred to “internal” memory, because the data resides internally on the microprocessor chip.

The other two memory banks also reside on the “core” board inside the Pilot Interface, but are contained on a separate socketed EEPROM chip (identified by the words “LEAKAGE TABLE” inside the Pilot Interface). These two memory banks are referred to “external” memory, because the data resides externally from the microprocessor chip.

While the internal memory banks will remain with the Pilot Interface, the external memory banks (on the socketed chip) can be removed and replaced into another Pilot Interface, to facilitate easy Pilot Interface replacement in the field and allowing the “leakage table” data to remain with the airplane when the Pilot Interface is replaced.

While the “leakage table” data should remain with the airplane in which it was calibrated (during dump-pit testing), the “analog calibration” values, which were factory-calibrated, should remain with the Pilot Interface.

There are two independent banks of memory on each of the internal and external memory EEPROMs. The primary bank (bank A, or “active” bank) is used for most operations. The secondary bank (bank B, or “backup” bank) is used only for backup purposes by factory personnel, and is available in the unlikely event that both external bank A and internal bank A memory banks become corrupted.

Upon system startup, the EXTERNAL memory is used to read system parameters. If the external memory fails to read properly (either because of a checksum error, I2C error, or an EEPROM chip error), the user is notified and given the option of continuing with system operation using the INTERNAL memory.

Whenever the system saves memory to EEPROM (such as after a leakage table learn operation), both the INTERNAL and EXTERNAL memories are written (bank A only, bank B is never written). Using this method, both external and internal memory banks are always identical, providing redundant backup to each other.

Failure Modes

The different memories (external or internal) are susceptible to different modes of failure.

Because the EXTERNAL memory requires sub-systems external to the microprocessor to work properly, it is somewhat more susceptible to errors. These errors might be caused by any of the following:

- physical damage (or electrostatic damage) to the EEPROM chip
- bad or intermittent contacts from the chip to its socket
- failure of the I2C sub-system which is used to read and write the EEPROM
- partial (interrupted) writes to the EEPROM, causing data corruption

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The INTERNAL memory, because it is internal to the microprocessor, is less susceptible to errors. These errors might be caused by the following:

- Accidental erasure of internal EEPROM caused by errors during ds30 chip programming
- physical damage (or electrostatic damage) to the ds30 microprocessor chip (very unlikely)

Objectives

The following are memory management objectives:

- Moving leakage calibration data from one Pilot Interface to another
- Identifying and recovering from a corrupted Pilot Interface unit
- Restoring factory values
- Restoring data from protected backup memory (bank B)
- Saving data to protected backup memory (bank B)
- Confirming digital signatures

Moving leakage calibration data from one Pilot interface to another

When replacing a damaged pilot interface (PI), it is recommended to move the leakage calibration data from the damaged PI and place it on the new PI. There are 2 ways to accomplish this:

1. Moving EEPROM chip (recommended method)
2. Manually entering data from hardcopy

Using removable EEPROM chip

The EEPROM contains the “leakage tables” when the aircraft was calibrated at the factory.

Damaging the IC leads can ruin the chip and cause an inability to access the data contained on it!

It is advised to have the following:

- IC removing tool
- IC installing tool
- IC leg straightener in case the IC leads are bent during the extraction or installation.

It is critical that the correct analog calibration and leakage tables are merged with the new units’ factory values:

Notes: It will be wise to clear any errors from the system before saving to memory, to do so press NO/MENU-Maint (press knob) – ClearErrors (press knob), Clear Err Counts (press knob), Clear ErrHistory (press knob).

1. Remove the top cover from the damaged PI (do NOT remove any screws from the bottom cover).
2. Remove top cover from new PI.
3. Remove EEPROM (IC17) from new PI and place aside; see Fig-1 & Fig-2 for EEPROM location.

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Figure 1

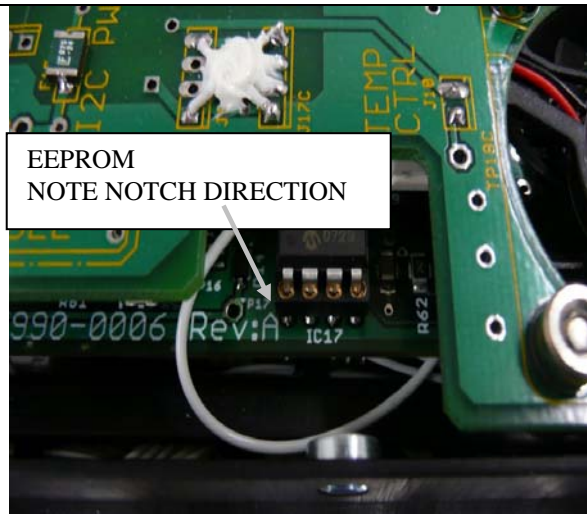


Figure 2

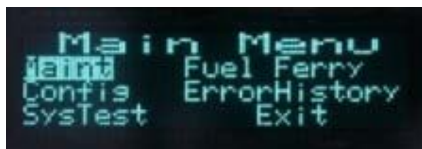
4. Remove EEPROM from damaged PI and place it in the new PI, **verify IC direction**, as inserting it in the wrong direction will damage the EEPROM, which will result in losing all calibration data.
5. Place cover back on new PI and install back on the aircraft.
6. Reassemble damaged unit and send in for factory repair if necessary.

In the following steps, the calibration data will be transferred to the new PI.

1. With the master power OFF, press and hold the “NO/MENU” switch, turn master power ON, do not release “NO/MENU” switch until the prompt below is displayed.



2. Press the “YES/FOAM” switch to use “FACTORY VALUES”.
3. When “Main AUTO display” appears, press “NO/MENU” to enter the main menu.
4. Select “Maint” and push selector knob.



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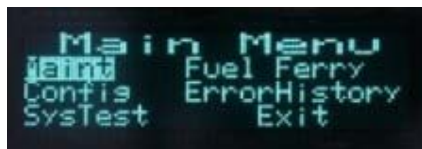
5. Select "Read EEprom" and push selector knob.



6. Select "Ext (leakage)" and push selector knob.



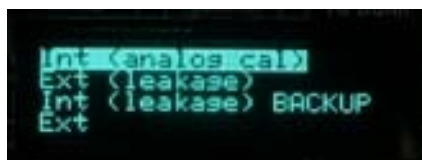
7. When "Main AUTO display" appears, press "NO/MENU" to enter main menu.
8. Select "Maint" and push selector knob.



9. Select "Read EEprom" and push selector knob.



10. Select "Int (analog cal)" and push selector knob.



11. When "Main AUTO display" appears, press "NO/MENU" to enter main menu.
12. Select "Maint" and push selector knob. *[Select clear errors (3 places) before saving to memory].*

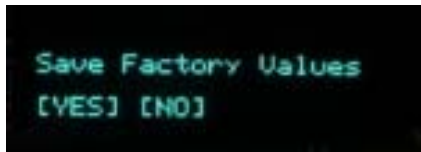


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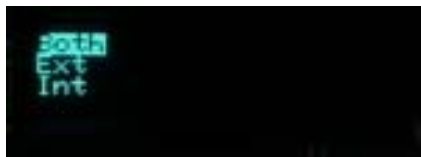
13. Select "Save Memory" and push selector knob.



14. You will get a message like the one below (this will not be shown on newer software version, skip to step 16).



15. Answer with "YES/FOAM" switch.
 16. Select "Both" and push selector knob (screen will switch to main screen and then will display "SaveMemory", which will disappear from the screen when complete).



17. If it is required or desired to save to the protected backup memory banks, follow directions at the end of this document. See "**Saving leakage and calibration data to protected backup memory**" otherwise skip to 18.
 18. The system should now be operational. The next test confirms the memory status.
 19. Follow the "Confirming digital signatures / fingerprints" section at the end of this manual to confirm the digital signatures of the analog calibration and leakage tables.

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Using hardcopy recorded data

This is not the most recommended way to reload leakage data and should only be attempted by personnel familiar with navigating and using the system! Read all the steps prior to attempting! This will familiarize you with the task.

In the following steps, the calibration data will be transferred to the new PI.

1. With the master power OFF, press and hold the “NO/MENU” switch. Turn master power ON, do not release “NO/MENU” switch until the prompt below is displayed.



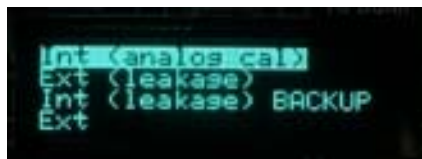
2. Press the “YES/FOAM” switch to use “FACTORY VALUES”.
3. When “Main AUTO display” appears, press “NO/MENU” to enter the main menu.
4. Select “Maint” and push selector knob.



5. Select “Read EEprom” and push selector knob.



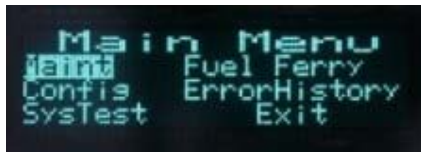
6. Select “Int (analog cal)” and push selector knob.



7. When “Main AUTO display” appears, press “NO/MENU” to enter main menu.

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- Select "Maint" and push selector knob.



- Select "Tweak Parameters" and push selector knob.



- Scroll down to Tweak 10. It should read 200 and it is the beginning of the 200Gal leakage area. As shown below, the tweak numbers display only even values. This is displaying in "Word" format instead of "Byte" format. This is required to make changes properly. If the display isn't shown as "Word" format, hold the "Lamp Test" switch up until the display changes to "Word" format.



Word format



Byte format

- Scroll until Tweak 12 is at the top of the screen.



Figure 3 - Tweaks in Word format

Actual value when a negative

Value being adjusted

- Press the "YES" switch. This should cause the Tweak to become highlighted indicating ready to modify. As shown in figure 4, Tweak 12 is a negative number (-19), negative numbers start at 65535 which equals -1 and decrements the more negative the number. The number to edit has the actual value displayed next to it when it's a negative number.
- Change the value in "12" to the .05 Coverage level value for 200 gallons. Obtain this from your hardcopy and press the "YES" switch to save the modification.
- Repeat steps 11 thru 13 for each of the leakage values for each coverage level and gallons to dump. There are 18 numbers to enter on the 802, three "Gallons to Dump" columns and six "Coverage Levels".

Below lists the Tweak number for each of the coverage levels for each of the gallons to dump. A detailed tweak list can be found in ER-0074, FRDS GEN2 SYSTEM OPERATION PARAMETERS (TWEAKS).

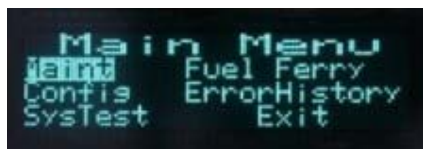
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This is a quick reference.

Tweak	Description	Values		Additional Description
200 gallon area of table				
10-11	200 Menu label	200 Do not change	200	
12-13	.05 Coverage level value	ENTER DATA HERE		
14-15	1.0 Coverage level value	ENTER DATA HERE		
16-17	2.0 Coverage level value	ENTER DATA HERE		
18-19	3.0 Coverage level value	ENTER DATA HERE		
20-21	4.0 Coverage level value	ENTER DATA HERE		
22-23	4.5 Coverage level value	ENTER DATA HERE		MAX level on AT802
24-25	5.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
26-27	6.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
28-29	6.5 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
400 gallon area of table				
30-31	400 Menu label	400 Do not change	400	
32-33	.05 Coverage level value	ENTER DATA HERE		
34-35	1.0 Coverage level value	ENTER DATA HERE		
36-37	2.0 Coverage level value	ENTER DATA HERE		
38-39	3.0 Coverage level value	ENTER DATA HERE		
40-41	4.0 Coverage level value	ENTER DATA HERE		
42-43	4.5 Coverage level value	ENTER DATA HERE		MAX level on AT802
44-45	5.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
46-47	6.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
48-49	6.5 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
600 gallon area of table				
50-51	600 Menu label	600 Do not change	600	
52-53	.05 Coverage level value	ENTER DATA HERE		
54-55	1.0 Coverage level value	ENTER DATA HERE		
56-57	2.0 Coverage level value	ENTER DATA HERE		
58-59	3.0 Coverage level value	ENTER DATA HERE		
60-61	4.0 Coverage level value	ENTER DATA HERE		
62-63	4.5 Coverage level value	ENTER DATA HERE		MAX level on AT802
64-65	5.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
66-67	6.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
68-69	6.5 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
800 gallon area of table				
70-71	800 Menu label	800 Do not change	800	N/A AT802 - AT1002 Only
72-73	.05 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
74-75	1.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
76-77	2.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
78-79	3.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
80-81	4.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
82-83	4.5 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
84-85	5.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
86-87	6.0 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
88-89	6.5 Coverage level value	Set to 1		N/A AT802 - AT1002 Only
End of leakage table				

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15. Once all values have been entered, you must save them to memory before cycling power or all values will be lost!
16. Press the “NO/MENU” switch to exit to the Main Screen.
17. When “Main AUTO display” appears, press “NO/MENU” to enter the main menu.
18. Select “Maint” and push selector knob. *[Select clear errors (3 places) before saving to memory].*



19. Select “Save Memory” and push selector knob.



20. Select “Both” and push selector knob (screen will switch to the main screen and then will display “SaveMemory” when complete).



21. If it is required or desired to save to the protected backup memory banks, follow directions at the end of this document. See “**Saving leakage and calibration data to protected backup memory**” otherwise skip to 22.
22. The system should now be operational. The next test confirms the memory status.
23. Follow the “Confirming digital signatures / fingerprints” section at the end of this manual to confirm the digital signatures of the analog calibration and leakage tables.

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Identifying and recovering from a corrupted Pilot Interface

Identification

Since normal boot up reads from the external EE first, corruption or damaged data can result in a malfunction. When a Pilot Interface External EE has become corrupted or has lost its calibrations for some reason, it will display 65535 in the Hydraulic Pressure (PSI) area of the Main Screen. This is also what happens with a new un-programmed unit or if the External EE chip is replaced with a new unformatted one.



The following steps should be followed to insure that no unintended non-factory parameters (tweaks) are set in the unit. This requires reloading factory values and restoring analog and leakage tables from **Internal** EEPROM.

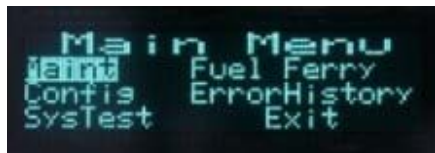
Restoring factory values

In the following steps, the calibration data will be transferred to the PI.

1. With the master power OFF, press and hold the “NO/MENU” switch, turn master power ON, do not release “NO/MENU” switch until the prompt below is displayed.



2. Press the “YES/FOAM” switch to use “FACTORY VALUES”.
3. When “Main AUTO display” appears, press “NO/MENU” to enter the main menu.
4. Select “Maint” and push selector knob.

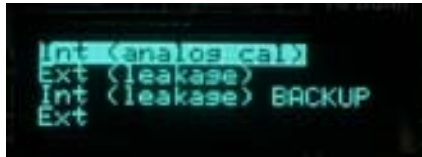


5. Select “Read EEprom” and push selector knob.

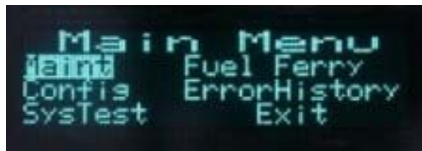


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- Select "Int (analog cal)" and push selector knob.



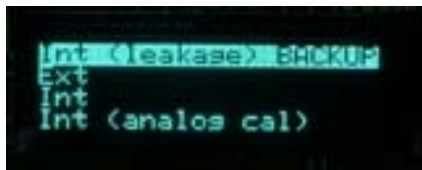
- When "Main AUTO display" appears, press "NO/MENU" to enter the main menu.
- Select "Maint" and push selector knob. *[Select clear errors (3 places) before saving to memory].*



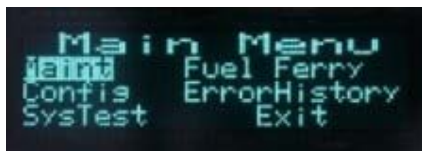
- Select "Read EEPROM" and push selector knob.



- Select "Int (leakage) BACKUP" and push selector knob.



- When "Main AUTO display" appears, press "NO/MENU" to enter the main menu.
- Select "Maint" and push selector knob.

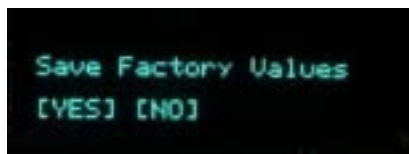


- Select "Save Memory" and push selector knob.



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14. You will get a message like the one below (this will not be shown on newer software version, skip to step 16).



- 15. Answer with “YES/FOAM” switch.
- 16. Select “Both” and push selector knob (screen will switch to main screen and then will display “SaveMemory” when complete).



- 17. When “SaveMemory” has cleared, cycle power to reset the system.
- 18. The system should now be operational. The next test confirms the memory status.
- 19. Follow the “Confirming digital signatures / fingerprints” section at the end of this manual to confirm the digital signatures of the analog calibration and leakage tables.

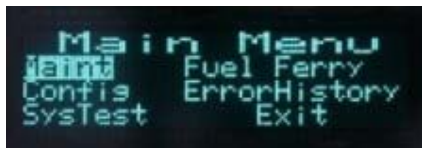
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Saving leakage and calibration data to protected backup memory

This process outlines saving data to the backup memory.

This process should only be performed after the GEN II unit has been mounted on an aircraft and has completed dump pit calibrations. This will save both the analog calibrations as well as dump pit calibrations to the protected memory.

1. Press "NO/MENU" to enter main menu.
2. Select "Maint" and push selector knob. *[Select clear errors (3 places) before saving to memory].*



3. Select "Save Memory" and push selector knob.



4. Select "Both" but DO NOT push the selector knob yet.



5. Hold "YES/FOAM" and "LAMP TEST" up at the same time.
6. Wait till Lamp Test function happens and then push selector knob.
7. Release "YES/FOAM" and "LAMP TEST".
8. Screen will switch to main screen and then will display "SaveMemory".



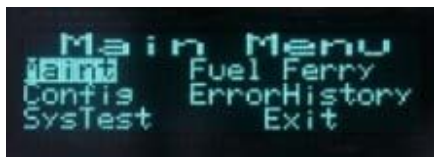
9. When "SaveMemory" has cleared, cycle power to reset the system.

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Restoring leakage and calibration data from backup memory

This process outlines restoring data from the backup memory. This process should only be done if the internal memory has been corrupted, erased or if instructed to by this or other documentation or factory personnel.

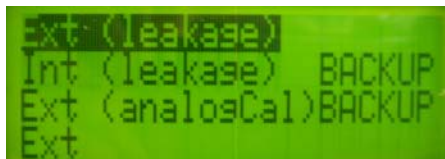
1. When "Main AUTO display" appears, press "NO/MENU" to enter the main menu.
2. Select "Maint" and push selector knob.



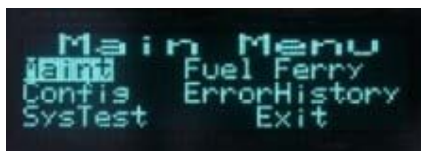
3. Select "Read EEPROM" and push selector knob.



4. Select "Ext (analogCal) BACKUP" but DO NOT push selector knob yet. This will copy only analog calibration, if leakage backup is needed as well, then repeat 1 ~ 3 and select "Int (leakage) BACKUP."



5. Hold "YES/FOAM" switch up.
6. Push selector knob.
7. Release "YES/FOAM", Main screen will appear.
8. Press "NO/MENU" to enter the main menu.
9. Select "Maint" and push selector knob. *[Select clear errors (3 places) before saving to memory].*

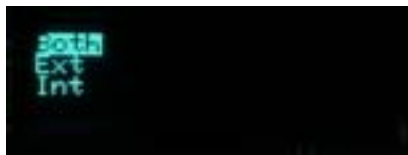


10. Select "Save Memory" and push selector knob.



TROTTER CONTROLS FORT WORTH, TEXAS	PROCESS SPECIFICATION		NUMBER	REVISION
	REPORT ORDER		PS-0035	B
TITLE GEN II FRDS Memory Management	BY		MODEL	
	LA / MP / JF		GEN II FRDS	
	CHK'D		SERIAL	
	CG		ALL	
DATE	REV. DATE	PAGE	OF	
10/01/10	9/29/11	16	20	

- Select "Both" and push selector knob (screen will switch to main screen and then will display "SaveMemory").



- When "SaveMemory" has cleared, cycle power to reset the system.
- Follow the "Confirming digital signatures / fingerprints" section at the end of this manual to confirm the digital signatures of the analog calibration and leakage tables.

TROTTER CONTROLS FORT WORTH, TEXAS	PROCESS SPECIFICATION		NUMBER	REVISION
	REPORT ORDER		PS-0035	B
TITLE GEN II FRDS Memory Management	BY	CHK'D	MODEL	
	LA / MP / JF	CG	GEN II FRDS	
	DATE	REV. DATE	SERIAL	
	10/01/10	9/29/11	ALL	
			PAGE	OF
			17	20

Confirming digital signatures / fingerprints

To confirm the digital signatures of the analog calibration and leakage tables in all four memory-banks, perform the following steps:



Figure 4 - Memory bank description

1. From “Main AUTO display”, press “NO/MENU” to enter main menu.
2. Select “Maint” and push selector knob.



3. Select “Compare RAM/EE” and push selector knob.



4. It may require holding the “Run Pump” switch down momentarily and pressing the selector knob to skip down to the display shown in the examples below.

TROTTER CONTROLS FORT WORTH, TEXAS	PROCESS SPECIFICATION		NUMBER	REVISION
	REPORT ORDER	<input checked="" type="checkbox"/>	PS-0035	B
TITLE GEN II FRDS Memory Management	BY	CHK'D	MODEL	
	LA / MP / JF	CG	GEN II FRDS	
	DATE	REV. DATE	SERIAL	
	10/01/10	9/29/11	ALL	
		PAGE	OF	
		18	20	

5. When the display appears, read the five sets of two digital signatures. Each bank should match. You can record this data for future reference if you desire. If they do not match, then the process wasn't successful. (Note image data below will differ for each aircraft).

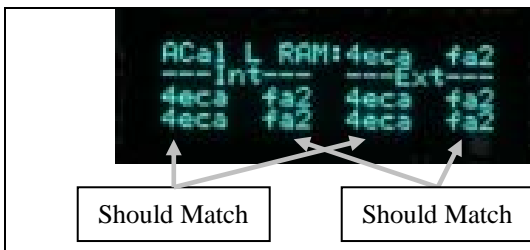


Figure 5 - Blank External "B" memory

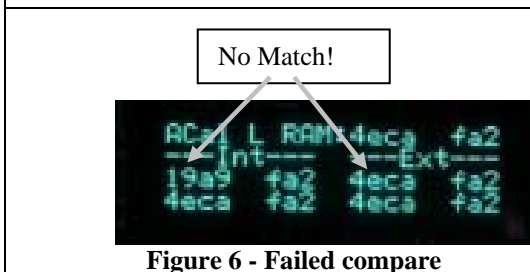


Figure 6 - Failed compare



Figure 7 - Blank external EE (both "A" and "B")

6. If the Internal or External "B" banks are 0 then the data must be backed up to the protected memory area. Follow directions in the "Saving leakage and calibration data to protected backup memory" section of this manual and then recheck.
7. Restart the system by cycling power or selecting "System Reset" from the "Maint" menu, confirming with the "YES/FOAM" switch.



8. Once the system restarts, it should be ready to operate normally.

TROTTER CONTROLS FORT WORTH, TEXAS	PROCESS SPECIFICATION		NUMBER	REVISION
	REPORT ORDER		PS-0035	B
TITLE GEN II FRDS Memory Management	BY <input checked="" type="checkbox"/> CHK'D		MODEL GEN II FRDS	
	LA / MP / JF CG		SERIAL ALL	
	DATE 10/01/10	REV. DATE 9/29/11	PAGE	OF
			19	20

Recovering from EEprom out of date error after firmware update

Sometimes when updating the firmware an EEprom out of date error occurs.

Follow the following steps to recover. Read completely through before attempting.

- Make sure Hydraulic power switch is off
- Make sure system Armed switch is off
- Cycle power to the PI unit while holding down “no” switch, Power will remain on through the rest of the processes
- When prompted to use factory values, select “yes” with yes switch
- Errors will most likely appear on the screen after boot up, use the run pump switch to try to clear them.
- Push menu switch
- Scroll and select Maint.
- Scroll and select “Read eeprom”
- Scroll and select “Int (analog cal)”
- Push select knob.

Unit will have read the values from internal memories.

Unit should go back to main screen.

- Push menu switch
- Scroll and select Maint.
- Scroll and select “Read eeprom”
- Scroll and select “Ext (leakage)”
- Push select knob.

Unit will have read the values from internal memories.

Unit should go back to main screen.

- Push menu switch
- Scroll and select Maint.
- Scroll and select “Save memory”
- Scroll and select “Both”

Unit will have wrote the values to memory

Unit should go back to main screen and “Save memory” may appear briefly.

Reboot PI unit.

It should boot correctly and no eeprom out of date error should appear.

The following is optional and should only be done by an Air tractor or Trotter controls representative or on there instruction to do so.

The following copies the working values to the protected backup memory.

On fully booted unit ready to operate, push the “Test lamps” switch.

This function must operate correctly for the following to work.

TROTTER CONTROLS FORT WORTH, TEXAS	PROCESS SPECIFICATION		NUMBER	REVISION
	REPORT ORDER		PS-0035	B
TITLE GEN II FRDS Memory Management	<input checked="" type="checkbox"/>		MODEL	
	BY LA / MP / JF		CHK'D CG	
	DATE 10/01/10		REV. DATE 9/29/11	
	SERIAL		GEN II FRDS	
		SERIAL		ALL
		PAGE	OF	
		20	20	

- Push menu switch
- Scroll and select Maint.
- Scroll and select "Save memory"
- Scroll to "Both" **Do not press yet**
- Hold "Lampstest switch" in Lampstest and wait for function to work and hold
- Select "Yes" switch and hold
- Press "Both" selection
- Release all switch's

Unit will have wrote the values to memory
Unit should go back to main screen and "Save memory" may appear briefly.

Reboot PI unit.
It should boot correctly and no eeprom out of date error should appear.

This should complete this process.