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FL-100-R (109) Operations and Installation Manual

This manual is certified for use with
instrument serial number

ASL000000

Use of this manual with any other
instrument voids all warranties and may
result in damage to the instrument

Congratulations on the purchase of your FL-100 Dual Fuel Level Indicator. This instrument is a complex precision instrument manufactured to exceed Airborne Equipment Standards DO-160D, DO-178B and TSO C55 standards. In order for your instrument to function correctly you will need to review the instructions in this brief manual.

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SECTION 1

Introduction

Your FL-100 Dual Fuel Level Indicator will provide you with years of reliable service and generally outlast the life of your aircraft. The instrument is constructed from the highest quality components and will provide a design life in excess of 100,000 hours.

It is the most reliable instrument of its kind. Gone are the days of questioning the accuracy or operation of the instrument. No stuck needles, erroneous readings or instruments that keep you guessing as to their operational status.

Every reading you will see displayed on your instrument has been validated 256 times before you see it. This all happens in less than a second. When you see the result you know the instrument is functioning correctly as it is monitored by an independent microprocessor just to insure that it is functioning correctly. In turn the main processor validates the independent monitoring processor. A failure detected in either processor will cause the instrument display to be turned off or an error message to be displayed, depending on the failure status.

Display

Under normal operations the main display of the instrument shows the status of both left and right tanks on the bar display, irrespective of the switch setting.



The lower four-digit seven-segment display provides a mathematically computed display of the selected parameters. The switch setting controls this display. When the switch is placed in the **L** position the **LEFT** LED indicator will be lit and the fuel quantity will be computed and displayed for the left tank. Likewise,



when the switch is placed in the **R** position the **RIGHT** LED indicator will be lit and the fuel quantity will be computed and displayed for the right tank.

Moving the switch momentarily to the **S** position will change the display option if applicable (See **SECTION 4 – Operation**).

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SECTION 2

Installation

The FL-100 will fit any standard 2 ¼" aircraft mounting hole. Place the instrument in the hole from the rear of the panel and then attach it with the four screws provided. If you need to replace the screws, ensure that the threads do not penetrate the instrument more than ½". Screws that penetrate the instrument further will cause severe damage to the instrument.

DISCONNECT ANY EXISTING FUEL INSTRUMENTS FROM THE FUEL SENDERS

This instrument will not work in conjunction with any other fuel indicating instruments.

Now connect the wiring as follows (See Page 4 for the Installation Schematic):

BLACK	Aircraft supply ground
RED	Master switched 14/28V bus (Instrument is internally fused)
ORANGE	Left tank sensor output
YELLOW	Right tank sensor output
BLUE	28V dimmer control (if required)
WHITE	14V dimmer control (if required)

**THIS IS THE MOST IMPORTANT STEP OF THE INSTALLATION
OMISSION OF THIS STEP VOIDS ANY AND ALL PRODUCT CERTIFICATIONS!**

Place the following placards within view of the pilot:

“Do not rely on indications from ANY fuel level instrument for flight safety”

AND

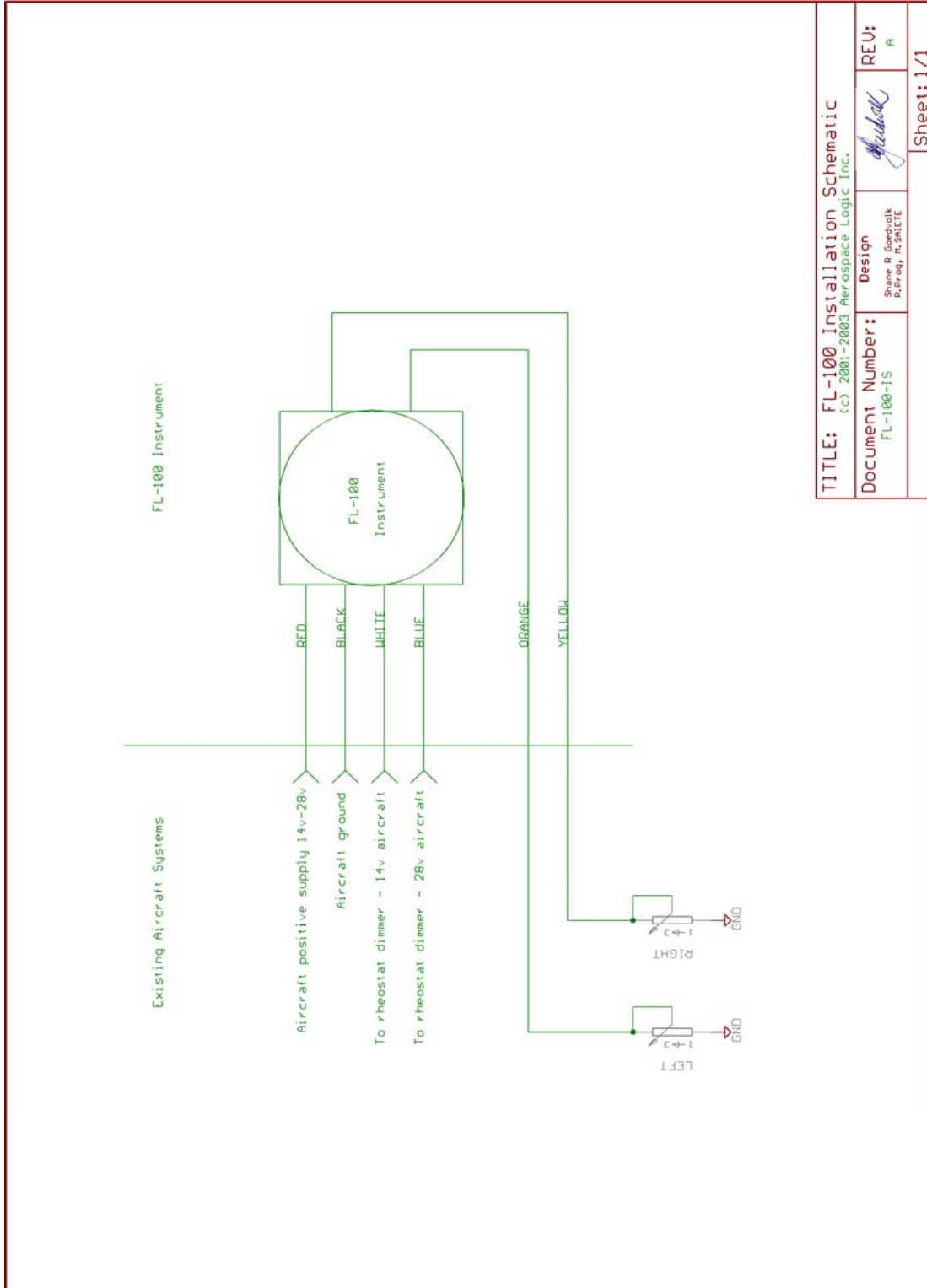
If the aircraft manufacturer has ANY limits or conditions associated with the original fuel gauge, they **MUST** be placed under this fuel gauge as well. Items such as minimum take-off capacities **MUST** be placarded.

Once installed your instrument will require setup and calibration before it may be commissioned for service.

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TITLE: FL-100 Installation Schematic (c) 2001-2003 Aerospace Logic Inc.		REU: A
Document Number: FL-100-IS	Design: Shane P. Goodwillk P.Eng., P. SP15TE	<i>Shane Goodwillk</i>
		Sheet: 1/1

SECTION 3

Setup and Calibration

Instrument setup is only required when a parameter or display configuration is to be changed. With proper planning you should only have to perform this function once in the life of the instrument. All information is stored in the instruments lifetime memory which will be retained without power for up to 100 years.

NOTE: When in the setup mode the two left most characters will have decimal points displayed with the specific characters. The display bars as well as LEFT and RIGHT LED indicators will be off at all times during the setup process.

STEP 1



To enter the Setup mode turn off the power to the instrument.

Then press and hold the switch in the **S** position and turn on the power.

Do not release the **S** switch during this process.

STEP 2



When the "Set-" message is displayed release the **S** switch.

The display will now show one of the two displays as follows depending on the instrument **b**rightness control source.

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STEP 3



The display will show either the **I**nternal or the **E**xternal setting depending on the previous selection.

By moving the switch between the **L** and **R** positions you can select the **b**rightness source for the control of the LED display.



An **I**nternal setting allows the intensity of the instrument display to be controlled using the switch on the front of the instrument while an **E**xternal setting allows the intensity of the instrument to be controlled using the panel rheostat.

Once the correct value is displayed move the switch to the **S** position and then back to the **R** position.

STEP 4

The instrument will now display the following two screens with a pause of about 3 seconds between the first and the last.



First the **CAL-** message is displayed and the display will then wait for user input at the **SurE** message point.



STEP 5

? *Do you want to perform the tank calibration at this point?*

- **NO** I just want to return the instrument to normal operations after changing or viewing the intensity setting for the instrument
 - *Then press the switch to the **S** position and release it. **Now proceed to SECTION 4 – Operation.***
- **YES** I want to perform the tank calibration for this instrument. I have completed the installation preparation as outlined in the **FL-100-R Installation Checklist and Guide as well as any applicable manufacturer guidelines.**
 - *Then move the switch to the **L** position and return it to the **R** position.*

STEP 6

The instrument will display either of these two options depending on the previous setting.

Now set the sender orientation

From the *FL-100-R Installation Checklist* select either **n** or **r** depending on the value in box #3.



You can change the setting from **n** to **r** and **r** to **n** by moving the switch to the **L** position and then back to the **R** position. Once the correct value is displayed move the switch to the **S** position and then back to the **R** position.

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STEP 7

? Do you want to calibrate the **LEFT** tank at this time?

- **NO** I want to either calibrate the **RIGHT** tank or exit the calibration process.
 - Then move the switch to the **S** position and back to the **R** position. **Now proceed to the STEP 16 on Page 12 of this document**
- **YES** I want to calibrate the **LEFT** tank now. I have completed the installation preparation as outlined in the **FL-100-R Installation Checklist and Guide as well as any applicable manufacturer guidelines.**
 - Then move the switch to the **L** position and then back to the **R** position.

STEP 8

Now read **BOTH STEP 8 and STEP 9** before performing them. Then perform **STEP 8 and STEP 9**.

YOU MUST HAVE YOUR CALIBRATION FORMS READY BEFORE CONTINUING (SECTION 5).



At this point you will allow the instrument to obtain the reference point where there is **no usable fuel in the tank**.

Ensure that only the **unusable** amount of fuel is in the tank.

Wait 20 seconds for the fuel to settle and then move the switch to the **S** position and back to the **R** position. Once the switch is in the **R** position the instrument will display one of the following:

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STEP 9



A number preceded by the letter **L** that will be displayed for three seconds and then the **L..1** display as in **STEP 11**.

If you received this display then note this number on the calibration sheet for this tank. See **SECTION 5** (Page 16 or 17) or the enclosed copy of the calibration sheet and proceed to **STEP 11**.

If you did not receive this display proceed to **STEP 10**

STEP 10



You received either an error message #3 or #5.

See **SECTION 6** to determine the cause of this error message. The instrument will return to the **L..0** display until you resolve the error condition.



If you have not completed the installation preparation as outlined in the **FL-100-R Installation Checklist and Guide as well as any applicable manufacturer guidelines** perform it before continuing with the calibration procedure. Do not continue this process until this has been done.

STEP 11



Now add one gallon of fuel to the tank.

Wait 20 seconds for the fuel to settle and move the switch to the **S** position and back to the **R** position.

Once the switch is in the **R** position the instrument will display one of the following:

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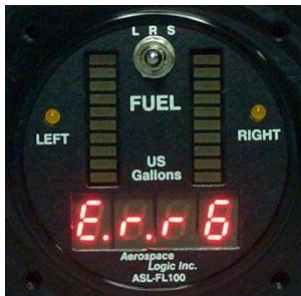
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STEP 12

A number preceded by the letter **L** that will be displayed for three seconds and then the **L..2** display as in **STEP 14**.

If you received this display then note this number on the calibration sheet from this tank. See **SECTION 5** (Page 16 or 17) or the enclosed copy of the calibration sheet and proceed to **STEP 14**.

If you did not receive this display then proceed to STEP 13.

STEP 13

Error #6, #7 or #8.

If you received this display then see **SECTION 6** to determine the cause of this error message. The instrument will return to the **L..1** display until you resolve the error condition.

If you have not completed the installation preparation as outlined in the **FL-100-R Installation Checklist and Guide as well as any applicable manufacturer guidelines** perform it before continuing with the calibration procedure.

STEP 14

Now add one gallon of fuel to the tank.

Wait 20 seconds for the fuel to settle and move the switch to the **S** position and back to the **R** position.

Once the switch is in the **R** position the instrument will display the next fuel quantity level to calibrate after displaying the calibration value that you need to record, as in **STEP 12**.

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STEP 15

Repeat **STEP 12** to **STEP 15** until the first of the following occurs:

1. The tank is full; **OR**
2. The sender reaches the maximum quantity of fuel it will indicate.

When either of the above conditions is met AND an error #6, #7 or #8 is displayed perform the following:

Move the switch to the **L** position and then back to the **R** position. The display should now look like this:



If all the conditions of this step have been met and you have completed the calibration of this tank then move the switch to the **L** position and then back to the **R** position.

If you completed this step for the LEFT tank then continue with **STEP 16** of this process.

If you completed this step for the RIGHT tank then continue with **STEP 18** of this process.

If all the conditions of this step have NOT been met and you wish to continue with the calibration of this tank then move the switch to the **S** position and then back to the **R** position. The instrument calibration will continue at the last step that was not completed.

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STEP 16

? Do you want to calibrate the RIGHT tank at this time?

- **NO** I want to exit the calibration process.
 - *Then move the switch to the **S** position and back to the **R** position. **Now proceed to the STEP 18 of the Setup and Calibration process***
- **YES** I want to calibrate the RIGHT tank now. I have completed the installation preparation as outlined in the **FL-100-R Installation Checklist and Guide as well as any applicable manufacturer guidelines.**
 - *Then move the switch to the **L** position and then back to the **R** position.*

STEP 17

Now perform STEP 8 through STEP 15 for the right tank. The entire process is exactly the same except that the instrument will display the **r** character instead of the **L** character in the leftmost position of the digital display for all steps.

Once **STEP 15** has been completed for the RIGHT tank proceed to **STEP 18**.

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STEP 18

The text **done** will be briefly displayed on the instrument and it will then restart in the normal operation mode.

One of the following three conditions will be met at this point:

1. You have reviewed the calibration process without calibrating the instrument.
The instrument may not be commissioned for use at this point.
2. You have calibrated either the LEFT or RIGHT tanks and may return to the calibration process at later point to complete the calibration process for the remaining tank.
The instrument may not be commissioned for use at this point.
3. You have completed calibration of both tanks.
Once the necessary documentation has been completed the instrument may be placed in service.

WARNING: This instrument may only be commissioned for legal use once the calibration procedure has been completed on BOTH LEFT AND RIGHT tanks.

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SECTION 4 Operation

STEP 1: Power Up



Once power is applied to the instrument it will scroll the text **FL-100** through on the digital display.

Then a **tEst** message will be displayed with all LED elements of the display lit.



Next the software version will be displayed. For this instrument it must be v205.

Finally the instrument will display four dash characters on the digital display. This display will remain on the instrument while it initializes the first fuel level measurement. This may take



up to 20 seconds to complete. Once the initial fuel level is displayed the instrument is ready for use.

STEP 2: General Operation – Fuel Level Display



Move the switch to the **L** position to display the fuel quantity in the LEFT tank. At the same time the LEFT LED will light up indicating that the digital display contains the fuel quantity in the LEFT tank.



By moving the switch to the **R** position the display will show the fuel quantity in the RIGHT tank. At the same time the RIGHT LED will light up indicating that the fuel quantity indicated in the digital display is for that of the RIGHT tank.

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STEP 3: General Operation – Display Intensity Control - External

If you set the intensity control to E (see **SECTION 3**) then the intensity of the instrument will be controlled by your panel rheostat.

Furthermore, moving the switch to the **S** position in normal operations more will have no effect on the operation of the instrument.

STEP 4: General Operation – Display Intensity Control – Internal

By moving the switch to the **S** position while the instrument is displaying the fuel quantity the display will change as shown.

The **n** character indicates that the *increase intensity operation* has been selected. The instrument will default to intensity level 32 and will retain the last set intensity level as long as power is applied to the instrument. Intensity level ranges are from 0 to 255 where 0 is the lowest level of intensity and 255 the highest.

To increase the intensity of the instrument move the switch to the **L** position. When the desired intensity level has been reached move the switch back to the **R** position. If you do not wish to increase the instrument intensity or have reached the desired intensity level, move the switch to the **S** position and then back to the **R** position. If you do not press the switch, the display will return to the fuel quantity display after a few seconds.



If you moved the switch to the **S** position from the increase intensity mode the display will now be as shown.

The **u** character indicates that the *decrease intensity operation* has been selected. The instrument will default to intensity level 32 after power up and will retain the last set intensity level as long as power is applied to the instrument. Intensity level ranges are from 0 to 255 where 0 is the lowest level of intensity and 255 the highest.

To decrease the intensity of the instrument move the switch to the **L** position. When the desired intensity level has been reached move the switch back to the **R** position. If you do not wish to decrease the instrument intensity or have reached the desired intensity level, move the switch to the **S** position and then back to the **R** position. If you do not press the switch, the display will return to the fuel quantity display after a few seconds.

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SECTION 5
FL-100 Calibration Form (Left Tank)

Instrument Serial # _____

0		25		50		75	
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	

Calibrated By: _____

Date: _____

Aircraft Registration: _____

SECTION 5
FL-100 Calibration Form (Right Tank)

Instrument Serial # _____

0		25		50		75	
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	

Calibrated By: _____

Date: _____

Aircraft Registration: _____

SECTION 6

Error Messages and Fault Resolution



During normal operations and the calibration process the instrument continually monitors operations to ensure that it operates in accordance with the necessary specifications.

While calibrating the instrument a number of parameters must be met in order for the instrument to be commissioned in an aircraft. This section will provide you with an identification of the error messages as well as possible problem resolutions. In all cases error messages are displayed as indicated to the left.

Error	Point of Occurrence	Resolution
1	Reserved	Contact our Technical Support department. You should never see this message.
2	Reserved	Contact our Technical Support department. You should never see this message.
3	L..0 or r..0 of the calibration process	<p>Cause: The fuel sender is not providing a valid indication of fuel for the zero fuel level. To qualify for installation into a certified aircraft the fuel sender must provide a valid zero fuel level indication to the instrument.</p> <p>Resolution (in order of probability):</p> <ol style="list-style-type: none"> 1. If you have not added the unusable fuel to the tank, do so now and return to the calibration process. 2. The fuel sender travel is not correctly set. Refer to the manufacturer documentation and correct the problem. 3. The fuel sender is defective. Replace it with a new or rebuilt unit. 4. If the sender orientation is set in the n mode check: <ol style="list-style-type: none"> a. for an open circuit condition between the instrument and the sender; b. that the sender is grounded; c. that the resistance specification of the sender matches that of the instrument.

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SECTION 6
Error Messages and Fault Resolution (Continued)

Error	Point of Occurrence	Resolution
4	Any time during normal operations or calibration	The instrument has detected an internal failure. Contact our Technical Support department for an RMA and shipment of a new instrument.
5	L..0 or r..0 of the calibration process	<p>Cause: The fuel sender is not providing a valid indication of fuel for the zero fuel level. To qualify for installation into a certified aircraft the fuel sender must provide a valid zero fuel level indication to the instrument.</p> <p>Resolution (in order of probability):</p> <ol style="list-style-type: none"> 1. If you have not added the unusable fuel to the tank do so now and return to the calibration process. 2. The fuel sender travel is not correctly set. Refer to the manufacturer documentation and correct the problem 3. The fuel sender is defective. Replace it with a new or rebuilt unit. 4. If the sender orientation is set in the r mode check: <ol style="list-style-type: none"> a. for an open circuit condition between the instrument and the sender; b. that the sender is grounded; c. that the resistance specification of the sender matches that of the instrument.

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SECTION 6
Error Messages and Fault Resolution (Continued)

Error	Point of Occurrence	Resolution
6	Any time AFTER L..0 or r..0	<p>Cause: The fuel sender output has not changed since the last calibration reading.</p> <p>Resolution (in order of probability):</p> <ol style="list-style-type: none"> 1. Did you add one gallon of fuel since the last calibration point? If not, do so now and continue with the process. 2. The fuel sender did not move with the addition of fuel: <ol style="list-style-type: none"> a. Is the fuel tank full? Go to SECTION 3 STEP 15 b. Has the fuel sender reached the maximum point of travel? <ol style="list-style-type: none"> i. If this point of travel is in agreement with the manufacturers stated travel then go to SECTION 3 STEP 15 ii. If this point of travel is not in agreement with the manufacturers stated travel then either adjust the sender or have it repaired. 3. If the fuel tank is not full, the sender has not reached the full point of travel and the sender has moved with the addition of fuel then the sender may be defective. Add up to two gallons of fuel in ¼ gallon increments checking to see if the error is cleared at each point. If the instrument allows progress to the next calibration step proceed with ¾ gallon increments until the additional fuel quantity has been compensated for. <p>If the error cannot be resolved within two gallons the sender must be repaired before continuing.</p>

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SECTION 6
Error Messages and Fault Resolution (Continued)

Error	Point of Occurrence	Resolution
7	Any time AFTER L..0 or r..0	<p>Cause: The fuel sender output has changed in the opposite orientation to that expected since the last calibration reading.</p> <p>Resolution (in order of probability):</p> <ol style="list-style-type: none"> 1. Is the sender orientation set correctly? See SECTION 3 STEP 6 2. Did you add one gallon of fuel since the last calibration point? If not, do so now and continue with the process. 3. Is the fuel tank full? Go to SECTION 3 STEP 15 4. Has the fuel sender reached the maximum point of travel? <ol style="list-style-type: none"> a. If this point of travel is in agreement with the manufacturers stated travel then go to SECTION 3 STEP 15 b. If this point of travel is not in agreement with the manufacturers stated travel then either adjust the sender or have it repaired. 5. If the fuel tank is not full, the sender has not reached the full point of travel and the sender has moved with the addition of fuel then the sender may be defective. Add up to two gallons of fuel in ¼ gallon increments checking to see if the error is removed at each point. If the instrument allows progress to the next calibration step proceed with ¾ gallon increments until the additional fuel quantity has been compensated for. <p>If the error cannot be resolved within two gallons the sender must be repaired before continuing.</p>

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SECTION 6
Error Messages and Fault Resolution (Continued)

Error	Point of Occurrence	Resolution										
8	Any time AFTER L..0 or r..0	<p>Cause: The fuel sender output exceeded the specified limits for the instrument.</p> <p>Resolution (in order of probability):</p> <ol style="list-style-type: none"> 1. Check that you have the correct instrument model for your sender: <table border="1" data-bbox="657 606 1380 814" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: center;">Maximum Sender Resistance</th> <th style="text-align: center;">FL-100 Model Required</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">44 Ω</td> <td style="text-align: center;">FL-100-R (44)</td> </tr> <tr> <td style="text-align: center;">67 Ω</td> <td style="text-align: center;">FL-100-R (67)</td> </tr> <tr> <td style="text-align: center;">109 Ω</td> <td style="text-align: center;">FL-100-R (109)</td> </tr> <tr> <td style="text-align: center;">300 Ω</td> <td style="text-align: center;">FL-100-R</td> </tr> </tbody> </table> 2. Is the fuel tank full? Go to SECTION 3 STEP 15 3. Has the fuel sender reached the maximum point of travel? <ol style="list-style-type: none"> a. If this point of travel is in agreement with the manufacturers stated travel then go to SECTION 3 STEP 15 b. If this point of travel is not in agreement with the manufacturers stated travel then either adjust the sender or have it repaired. 4. If the fuel tank is not full, the sender has not reached the full point of travel and the correct instrument model is being used then the sender is defective. The sender must be repaired before continuing. 	Maximum Sender Resistance	FL-100 Model Required	44 Ω	FL-100-R (44)	67 Ω	FL-100-R (67)	109 Ω	FL-100-R (109)	300 Ω	FL-100-R
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109 Ω	FL-100-R (109)											
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9	When the calibration process is ended	<p>Cause: The instrument must be calibrated for a minimum of 10 gallons of fuel.</p> <p>Resolution: Continue the calibration process until a minimum of 10 gallons is reached.</p>										

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SECTION 7
FL-100-R (109) Specifications

<p>Dimensions:</p> <ul style="list-style-type: none"> • Fits standard 2.25" mounting hole • 2.45" X 2.45" X 1.6" • 2" viewing area • Weight: 8oz <p>Display</p> <ul style="list-style-type: none"> • Custom design color bar display • Multi-color sunlight visible • InGaAlPGaN LED technology • 100,000 hours operating life • Analog and digital readout of fuel levels <p>Ranges (per tank)</p> <ul style="list-style-type: none"> • Minimum 10 US Gallons • Maximum 99 US Gallons <p>Accuracy</p> <ul style="list-style-type: none"> • Better than 1% • Exceeds requirements of AS405 <p>Safety</p> <ul style="list-style-type: none"> • Color coded fuel level quantities • Low fuel level alarms • Dual processor monitoring with one second error shutoff • Internal over temperature shutoff • Floating point mathematical compensation for tank and sensor linearity • 256 times measurement validation before display • .25 second scan rate <p>Operating Temperature</p> <ul style="list-style-type: none"> • -15C to +55C • 5F to 131F <p>Power Consumption</p> <ul style="list-style-type: none"> • 450mA Max (daytime operation) • 60mA Min (nighttime operation) 	<p>Programmable Display</p> <ul style="list-style-type: none"> • Two brightness selection pages (internal intensity selection) <p>Intensity Control</p> <ul style="list-style-type: none"> • Programmable user option • External using standard rheostat type dimmer • Internal selection programmable from the front panel • 256 level of brightness <p>Linearity</p> <ul style="list-style-type: none"> • Programmable for each tank • One gallon increments • Sensor linearity compensation • Tank design linearity compensation • Performed only once <p>Operating Voltage</p> <ul style="list-style-type: none"> • 6V-32V DC <p>Sensors Supported</p> <ul style="list-style-type: none"> • <i>Resistive sensors of all types where:</i> • $R_{max} = 109 \text{ Ohms}$ • $R_{min} = 0 \text{ Ohms}$
 <p style="text-align: center;">All specification subject to change © 2002-2004 Aerospace Logic Inc.</p>	

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