

INSTRUCTIONS for CONTINUED AIRWORTHINESS

For

**FC-110 AUTOPILOT COMPUTER MODIFIED WITH
REPLACEMENT CIRCUIT BOARDS
PER STC ST02097SE (Amended)**

In

LEARJET 20 SERIES AIRPLANES

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**Butler National Corporation
11920 W. 161st Street
Olathe, KS 66062**

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Butler National Corporation
19920 W. 161st Street
Olathe, KS 66062

www.butlernational.com

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I PURPOSE

This document describes the Instructions for Continued Airworthiness (ICA) for J.E.T. brand FC-110 Autopilots which have had the FC-110 Autopilot Computer Modified per Butler National Installation Manual 01807005 with replacement circuit boards.

A. SPECIFIC MAINTENANCE for FC-110 REPLACEMENT CIRCUIT BOARDS

No specific maintenance procedures are associated with the installation of replacement circuit boards into the FC-110 Autopilot Computer other than performance of Ground Test per Appendix B of this document and performance of the autopilot checklist items in the aircraft flight manual. (Note: Ground Test procedures in Appendix B and Butler National Installation Procedure 01807005 are identical.)

B. SERVICE LIMIT

Maintenance of the autopilot computer installed with replacement Butler National circuit boards is on condition.

The autopilot should be ground checked annually or every A-Check, whichever occurs first.

II AIRWORTHINESS LIMITATIONS

A. STRUCTURAL

There are no new (or additional) structural inspection intervals, structural inspection procedures, or mandatory structural replacement times associated with this equipment and/or installation.

B. FUEL SYSTEM

No fuel tank system changes are associated with this equipment and/or installation.

C. APPROVAL

There are no new (or additional) Airworthiness Limitations associated with this equipment and/or installation.

The Airworthiness Limitations Section is FAA approved and specifies maintenance required under 14 CFR §§ 43.16 and 91.403 of the Federal Aviation Regulations, unless an alternative program has been FAA approved.

III PROCEDURE

A. SYSTEM GROUND TEST

The FC-110 Autopilot system is to be Ground tested in the aircraft per Appendix B of this document.

If the FC-110 system passes Ground Test, no further action is required for the installation of the FC-110 computer. Actuators, gyroscopes and other Line Replaceable Units (LRUs) are to be maintained according to the respective Maintenance Manual.

B. SYSTEM TROUBLESHOOTING

If the FC-110 system fails Ground Testing, perform Troubleshooting per Appendix A of this document. Appendix A has been excerpted from the J.E.T. FC-110 Instruction Manual.

C. FC-110 COMPUTER MODIFICATION

If the FC-110 Autopilot Computer is deemed to have failed Circuit Boards, refer to Butler National Installation Manual 01807005 for board removal instructions. Contact Butler National for further assistance.

D. RETURN-TO-SERVICE

With all FC-110 Autopilot components in proper functioning condition, install the autopilot computer in the aircraft and perform Ground Test per Appendix B. Record results in spaces provided in Appendix B. Place a copy of Ground Test results in the aircraft maintenance records.

E. PERFORMANCE TEST, TAILORING

Perform a test flight with aircraft, to verify proper autopilot operation per FC-110 Autopilot Instruction Manual. If necessary, adjust gains and record settings per FC-110 Autopilot Instruction Manual.

Settings are to be recorded on the appropriate model-specific version of FC-110 AFCS Calibration Card, per FC-110 Autopilot Instruction Manual. Place a copy of AFCS Calibration Card in the aircraft maintenance records.

Important----Be sure to refer to the correct, model-specific version of the FC-110 Autopilot Instruction Manual.

Troubleshooting may be done per Appendix A of this document

IV APPENDIX A; TROUBLESHOOTING

The information in Appendix A, Troubleshooting, has been excerpted from J.E.T. FC-110 Autopilot Instruction Manual. Refer to the model-specific version of the Instruction Manual as needed / as directed by Appendix A.

Table 1, FC-110 SYSTEM TROUBLESHOOTING

<u>YAW AXIS</u>		
<u>SYMPTOM</u>	<u>PROBABLE CAUSE</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
Yaw Axis overshoot or oscillation	1. FU pot. mis-adjusted 2. VEL GEN pot. mis-adjusted 3. RATE GYRO pot. mis-adjusted 4. ACCEL pot. mis-adjusted	1. Increase FU adjustment 2. Increase VEL GEN adjustment 3. Decrease RATE GYRO adjustment 4. Decrease ACCEL adjustment
Yaw Axis undershoot	1. FU pot. mis-adjusted 2. RATE GYRO mis-adjusted 3. ACCEL pot. mis-adjusted	1. Decrease FU adjustment 2. Increase RATE GYRO adjustment 3. Increase ACCEL adjustment
Hardover when landing gear and flaps are lowered	1. Defective RATE GYRO	1. Replace RATE GYRO
Aircraft slips in turns	1. ACCEL pot. set too low	1. Increase ACCEL adjustment
Aircraft skids in turns	1. ACCEL pot. set too high	1. Decrease ACCEL adjustment
Hardover upon Yaw Damper engagement	1. Yaw Follow-up phasing reversed 2. Defective Yaw Servo Amplifier Module 3. Defective Yaw Servo Actuator 4. Defective Yaw Calibration Module	1. Re-null Yaw Follow-up and check for correct phasing 2. Replace Yaw Servo Amplifier Module 3. Replace Yaw Servo Actuator 4. Replace Yaw Calibration Module
<u>ROLL AXIS</u>		
<u>SYMPTOM</u>	<u>PROBABLE CAUSE</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
Aircraft turns when AFCS is engaged (hardover)	1. Primary Directional Gyro defective 2. Pilot's or co-pilot's Trim Switch defective 3. Roll Follow-up nulled 180° out of phase 4. Defective Roll Servo Amplifier Module 5. Defective Roll Servo Actuator 6. Roll Calibration Module mis-adjusted	1. Replace Primary Directional Gyro. (swap PRI & SEC DG's to verify discrepancy) 2. Replace defective switch 3. Check Roll Follow-up phasing and re-null as required 4. Replace Roll Servo Amplifier Module 5. Replace Roll Servo Actuator 6. Adjust Roll Calibration Module per Table 2-3 or 2-4



ROLL AXIS (CONT')		
SYMPTOM	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
Aircraft overshoots or oscillates.	<ol style="list-style-type: none"> 1. FU pot. set too low 2. VEL GEN mis-adjusted 3. DISPL pot. mis-adjusted 4. CRS pot. mis-adjusted 5. Defective Vertical Gyro 	<ol style="list-style-type: none"> 1. Increase FU adjustment 2. Increase VEL GEN adjustment 3. Decrease DISPL adjustment 4. Decrease CRS adjustment 5. Replace Vertical Gyro
Aircraft overshoots	<ol style="list-style-type: none"> 1. FU pot. mis-adjusted 2. RATE GYRO pot. mis-adjusted 3. DISPL pot. mis-adjusted 	<ol style="list-style-type: none"> 1. Decrease FU adjustment 2. Increase RATE GYRO adjustment 3. Increase DISPL adjustment
Loose Heading Hold	<ol style="list-style-type: none"> 1. HDG pot. mis-adjusted 	<ol style="list-style-type: none"> 1. Increase HDG adjustment
Servo Actuator Buzz (high quiescent correct)	<ol style="list-style-type: none"> 1. VEL GEN pot. set too high 2. Servo Amplifier Module R27 mis-adjusted 	<ol style="list-style-type: none"> 1. Decrease VEL GEN adjustment 2. Decrease R27 adjustment
Roll Mode Buttons will not remain engaged when depressed (AFCS "ON" lamp illuminated)	<ol style="list-style-type: none"> 1. No roll power 2. Turn knob out of detent 3. Defective Lateral Coupler Signal Module 	<ol style="list-style-type: none"> 1. Check circuit breakers and interconnect wiring 2. Check turn knob and turn relay 3. Replace Lateral Coupler Signal Module
Reverse response to Roll Axis inputs	<ol style="list-style-type: none"> 1. Defective Roll Servo Amplifier Module 2. Defective Roll Servo Actuator 3. Defective Roll Calibration Module 4. Defective interconnect wiring 	<ol style="list-style-type: none"> 1. Replace Roll Servo Amplifier Module 2. Replace Roll Servo Actuator 3. Replace Roll Calibration Module 4. Check interconnect wiring
High or low sensitivity to Course Select or Heading Select signals	<ol style="list-style-type: none"> 1. Improperly adjusted or defective Lateral Coupler Signal Module 2. Defective Navigation Receiver 3. Defective HSI heading synchro 	<ol style="list-style-type: none"> 1. Adjust or replace Lateral Coupler Signal Module as required 2. Replace Navigation Receiver 3. Replace HSI
High or low sensitivity to VOR and LOC signals	<ol style="list-style-type: none"> 1. Improperly adjusted Lateral Coupler Signal Module 2. Improperly adjusted Lateral Coupler Logic Module 3. Improper NAV signal 	<ol style="list-style-type: none"> 1. Adjust Lateral Coupler Signal Module. Refer to Table 2-3 or 2-4 2. Adjust Lateral Coupler Logic Module. Refer to Table 2-3 or 2-4 3. Refer to NAV Receiver Maintenance Manual



PITCH AXIS		
SYMPTOM	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
Aircraft Porpoises in all modes	<ol style="list-style-type: none"> 1. Defective Primary Vertical Gyro 2. Defective Pitch Servo Actuator 3. Pitch Servo Amplifier Module adjusted incorrectly 4. FU pot. mis-adjusted 5. VEL GEN pot. mis-adjusted 6. RATE GYRO pot. mis-adjusted 7. DISPL pot. mis-adjusted 8. Capstan torque low 	<ol style="list-style-type: none"> 1. Replace Primary Vertical Gyro 2. Replace Pitch Servo Actuator 3. Increase Servo Amplifier Module R27 adjustment 4. Increase FU adjustment 5. Increase VEL GEN adjustment 6. Decrease RATE GYRO adjustment 7. Decrease DISPL adjustment 8. Check capstan torque and elevator interconnect cable tensions
Slow Pitch oscillation in G/S mode	<ol style="list-style-type: none"> 1. Longitudinal Coupler Module improperly adjusted 	<ol style="list-style-type: none"> 1. Decrease INT adjustment
Pitch Attitude changes when Autopilot is disengaged	<ol style="list-style-type: none"> 1. Aircraft Pitch Trim is insufficient 	<ol style="list-style-type: none"> 1. Increase Aircraft Pitch Trim
Pitch Attitude changes when ALT, SPD, or G/S is disengaged	<ol style="list-style-type: none"> 1. Longitudinal Coupler defective or improperly adjusted 2. Defective Navigatrion Receiver 3. Defective interconnect wiring 	<ol style="list-style-type: none"> 1. Readjust or replace Longitudinal Coupler Module 2. Refer to NAV Receiver Maintenance Manual 3. Check interconnect wiring
Will not enter Automatic Glide Slope	<ol style="list-style-type: none"> 1. Longitudinal Coupler Module defective or improperly adjusted 2. Defective Navigation Receiver 3. Defective interconnect wiring 	<ol style="list-style-type: none"> 1. Readjust or replace Longitudinal Coupler Module 2. Refer to NAV Receiver Maintenance Manual 3. Check interconnect wiring
No Pitch Synchronization	<ol style="list-style-type: none"> 1. Fuse F1 blown in Flight Controller 2. Defective Pitch Servo Amplifier Module 3. Defective interconnect wiring 4. Defective Flight Controller 5. 3/8 Amp Fuse on Servo Amplifier Module blown 	<ol style="list-style-type: none"> 1. Replace 3/8 Amp Fuse F1 2. Replace Servo Amplifier Module 3. Check interconnect wiring 4. Replace Flight Controller 5. Replace 3/8 Amp Fuse
No Pitch Integration	<ol style="list-style-type: none"> 1. Longitudinal Coupler Module improperly adjusted or defective 2. Defective signal or low speed relays 3. Defective interconnect wiring 	<ol style="list-style-type: none"> 1. Adjust INT on Longitudinal Coupler or replace unit if defective 2. Check relays, isolate, and replace defective assembly or sub-assembly as required 3. Check interconnect wiring.

<u>PITCH AXIS (Cont'd)</u>		
<u>SYMPTOM</u>	<u>PROBABLE CAUSE</u>	<u>RECOMMENDED CORRECTIVE ACTION</u>
No Automatic Pitch Trim	<ol style="list-style-type: none"> 1. Trim Coupler Module defective or improperly adjusted 2. Defective Pitch Trim Actuator (stabilizer actuator) 3. Defective interconnect wiring 	<ol style="list-style-type: none"> 1. Adjust or replace Trim Coupler Module as required 2. Replace Trim Actuator 3. Check interconnect wiring
Reversed or no response from Pitch Servo Actuator	<ol style="list-style-type: none"> 1. Defective Pitch Calibration Module, Pitch Servo Amplifier Module, or Trim Coupler Module 2. Defective Pitch Servo Actuator 3. Defective interconnect wiring 4. 3/8 Amp Fuse on Pitch Servo Amplifier Module blown 	<ol style="list-style-type: none"> 1. Replace defective module 2. Replace Pitch Servo Actuator 3. Check interconnect wiring 4. Replace 3/8 Amp Fuse
Oscillation in ALT or SPD HOLD modes	<ol style="list-style-type: none"> 1. Defective Air Data Sensor 	<ol style="list-style-type: none"> 1. Replace Air Data Sensor
Reversed response to ALT, SPD, and/or GLIDE SLOPE signals	<ol style="list-style-type: none"> 1. Defective Longitudinal Coupler 2. Defective signal source 3. Defective interconnect wiring 	<ol style="list-style-type: none"> 1. Replace Longitudinal Coupler Module 2. Check and replace Air Data Sensor or Navigation Receiver as required 3. Check interconnect wiring
Aircraft pitches nose-up or nose-down upon AFCS engagement	<ol style="list-style-type: none"> 1. Defective pilot's or co-pilot's Trim Switch 	<ol style="list-style-type: none"> 1. Remove and replace defective switch



V APPENDIX B; GROUND TEST

Perform Ground Test per Table 2. Record results in spaces provided in Table 2. Place a copy of Ground Test results in the aircraft maintenance records.

Table 2, GROUND TEST PROCEDURE AND RESULTS

TASK		RESPONSE	PASS/ FAIL	COMMENTS
1.	Ensure Autopilot circuit breakers are in.	Check		
2.	Place BATTERY L/R switches to ON.	Check		
3.	Place INVERTER PRI/SEC switches to ON.	Autopilot OFF (amber lamp) shall illuminate. ATTITUDE INDICATOR GYRO and COMPUTER Flags out-of-view. HSI COMPASS Flag out-of-view.		
4.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate Autopilot ON (green lamp) shall illuminate.		
5.	Press and hold A/P TEST-TRIM MON switch to UP.	Autopilot shall disengage within 5 seconds.		
6.	Release A/P TEST-TRIM MON switch.			
7.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Autopilot ON (green lamp) shall illuminate.		
8.	Press and hold A/P TEST- TRIM MON switch to DN.	Autopilot shall disengage within 5 seconds.		
9.	Release A/P TEST-TRIM MON switch.			
10.	Rotate HSI HDG KNOB to align HEADING BUG to aircraft heading.	HEADING BUG aligned to aircraft heading.		
11.	Rotate HSI COURSE KNOB to align COURSE POINTER on aircraft heading.	COURSE POINTER aligned to aircraft heading.		
12.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Autopilot ON (green lamp) shall illuminate.		



TASK		RESPONSE	PASS/ FAIL	COMMENTS
13.	Rotate Autopilot TURN KNOB for right turn.	Control wheels turn right.		
14.	Rotate Autopilot TURN KNOB for left turn.	Control wheels turn left.		
15.	Rotate Autopilot TURN KNOB to center (detent).	Control wheels are level.		
16.	Rotate Autopilot PITCH COMMAND THUMBWHEEL to nose DN.	Control wheels are forward.		
17.	Rotate Autopilot PITCH COMMAND THUMBWHEEL to nose UP.	Control wheels move aft.		
18.	Press Autopilot HDG button.	HDG button illuminates.		
19.	Rotate HSI HDG KNOB 90° right.	Control wheels turn right.		
20.	Rotate HSI HDG KNOB 90° left.	Control wheels turn left.		
21.	Rotate HSI HDG KNOB to align HEADING BUG to aircraft heading.	Control wheels return to level.		
22.	Press Autopilot ALT button.	ALT button illuminates.		
23.	Rotate Autopilot PITCH COMMAND THUMBWHEEL to nose DN.	ALT shall disengage. HDG remains engaged.		
24.	Press Autopilot ALT button.	ALT button illuminates.		
25.	Rotate Autopilot PITCH COMMAND THUMBWHEEL to nose UP.	ALT shall disengage. HDG remains engaged.		
26.	Press Autopilot ALT button.	ALT button illuminates.		



TASK		RESPONSE	PASS/ FAIL	COMMENTS
*27.	Apply approx. 8 lbs. nose down force to control wheel.	ALT and HDG disengage.		
*28.	Press Autopilot HDG and ALT buttons.	HDG and ALT buttons illuminate.		
*29.	Apply approx. 8 lbs. nose down force to Control Wheel.	ALT and HDG disengage.		
¹ 30.	Press Autopilot HDG and ALT buttons.	HDG button illuminates.		
31.	Rotate Autopilot TURN KNOB to right and then back to center.	HDG shall disengage. ALT remains engaged.		
32.	Press Autopilot HDG button.	HDG button illuminates.		
33.	Rotate Autopilot TURN KNOB to left and then back to center.	HDG shall disengage. ALT remains engaged.		
34.	Press Autopilot HDG button.	HDG button illuminates.		
35.	Press Autopilot SPD button.	SPD button illuminates. ALT shall disengage. HDG remains engaged.		
36.	Rotate Autopilot TURN KNOB to right and then back to center.	HDG shall disengage SPD remains engaged.		
37.	Press Autopilot HDG button.	HDG button illuminates.		
38.	Rotate Autopilot TURN KNOB to left and then back to center.	HDG shall disengage. SPD remains engaged.		
39.	Press Autopilot HDG button.	HDG button illuminates.		

¹ TASKS 27 thru 30 not applicable to Model 28 or 29 aircraft.



TASK		RESPONSE	PASS/ FAIL	COMMENTS
40.	Rotate Autopilot PITCH COMMAND THUMBWHEEL to nose DN.	SPD shall disengage. HDG remains engaged.		
41.	Press Autopilot SPD button.	SPD button illuminates.		
42.	Rotate Autopilot PITCH COMMAND THUMBWHEEL to nose UP.	SPD shall disengage. HDG remains engaged.		
43.	Disengage Autopilot using AFCS RELEASE/NOSE WHEEL STEERING button.	Autopilot shall disengage. Aural tone shall sound. All modes disengage.		
44.	Turn No. 1 NAV to local VOR or ILS frequency.	VOR/LOC flag out-of-view.		
45.	Rotate HSI COURSE KNOB to move COURSE POINTER until COURSE DEVIATION INDICATOR centers.	COURSE DEVIATION INDICATOR centers over symbolic AIRCRAFT.		
46.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Autopilot ON (green lamp) shall illuminate.		
47.	Press Autopilot NAV button.	NAV button illuminates.		
48.	Rotate HSI COURSE KNOB left then right.	COURSE DEVIATION INDICATOR (CDI) shall deflect left then right; and Control Wheels shall follow needle deflection (see note). Note If COURSE POINTER is aligned to station reciprocal bearing, Control Wheels will turn opposite CDI deflection.		
NOTE				
G/S cannot be tested on the ground without use of test equipment. A ground stations simulator may be used to check G/S, HSI, and aircraft controls.				



TASK		RESPONSE	PASS/ FAIL	COMMENTS
49.	Depress pilot's AFCS RELEASE/NOSE WHEEL STEERING button.	Autopilot shall disengage. Aural tone shall sound.		
50.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Green lamp shall illuminate.		
51.	Depress co-pilot's AFCS RELEASE/NOSE WHEEL STEERING button.	Autopilot shall disengage. Aural tone shall sound.		
52.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Green lamp shall illuminate.		
53.	Command NOSE UP TRIM using pilot's TRIM SWITCH.	Autopilot shall disengage. Aural tone shall sound.		
54.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Green lamp shall illuminate.		
55.	Command NOSE UP TRIM using co-pilot's TRIM SWITCH.	Autopilot shall disengage. Aural tone shall sound.		
56.	Place PITCH TRIM switch to EMERGENCY.	Autopilot shall disengage. Aural tone shall sound.		
57.	Press Autopilot ENGAGE button.	Autopilot ENGAGE shall illuminate. Green lamp shall illuminate.		
58.	Press Autopilot HDG and ALT buttons.	HDG and ALT buttons illuminate.		
59.	Depress and hold pilot's MANEUVER CONTROL button.	HDG and ALT shall disengage. Control Wheels shall have freedom of movement in the pitch and roll axes.		
60.	Release pilot's MANEUVER CONTROL button.	Control Wheels shall resist movement signifying autopilot is active.		



TASK		RESPONSE	PASS/ FAIL	COMMENTS
61.	Disengage Autopilot.	Autopilot ENGAGE disengages. Green lamp OFF, Amber lamp ON.		
62.	Depress one rudder pedal.	Rudder pedal remains depressed.		
63.	Engage PRI YAW DAMPER.	Rudder pedal shall center.		
64.	Place YAW DAMPER selector switch in SECONDARY position.	YAW DAMPER ON will disengage.		
65.	Depress one rudder pedal.	Rudder pedal remains depressed.		
66.	Place SECONDARY YAW DAMPER switch to ENGAGE.	Rudder pedal shall center.		
67.	Place YAW DAMPER selector switch to PRI position.			
68.	Place INVERTER PRI/SEC switch to OFF.	Amber light OFF.		
69.	Place BATTERY L/R switches to OFF.			

END OF GROUND TEST

VI FORM COMPLETION / DATA RETENTION

Complete aircraft Return-to-Service Forms and Logbook entries with STC number. Retain Ground Test data in aircraft records.

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