

Stormscope®

Series II Weather Mapping Systems

WX-1000 Installation Manual

This manual contains installation instructions and recommended flightline maintenance information for the WX-1000 *Stormscope* Systems. This information is supplemented and kept current by Change Notices and Service Bulletins published by BFG FlightSystems.

BFGoodrich
FlightSystems
incorporated

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BFGoodrich FlightSystems, Inc.
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Columbus, Ohio 43240

7 October, 1994
Change 3

FOREWORD

This manual provides information intended for use by persons who, pursuant to current regulatory requirements, are qualified to operate this equipment. Because the installation of equipment to be tested may vary depending on a particular aircraft, this manual is intended as a guideline. If further information is required, contact:

BFGoodrich FlightSystems, Inc.
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We welcome your comments concerning this manual. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the manual part number, the paragraph/figure/table number, and the page number. Send your comments to:

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SERVICE MEMO

- A. **EFFECTIVITY:** WX1000E 429 Navaid System Interface
- B. **REASON:** Notification of Interface capabilities.
- C. **COMPLIANCE:** For information only.
- D. **DESCRIPTION:** The following is a list of the interfaces currently available.

NOTE! The WX1000E 429 Navaid can only use the LOW SPEED ARINC 429 output data.

Trimble

WX1000E Navaid 429 System will work with a TNL-7880 NPU or an AR/ARN-148 with software version -071 and using the LOW SPEED ARINC 429 output data.

For older systems with software versions ending in 011 or 051 consult the Product Support Department first. Software versions ending in 010 or X10 will NOT work.

Universal

WX1000E Navaid 429 System will work with a UNS-1, UNS-1A, or most UNS-1B system provided the software version is 13.X, 14.X, or 15.X where X is 1-9. Additionally the LOW SPEED ARINC 429 output data must be used.

Global

WX1000E Navaid 429 System will work with the GNS-X provided the system is configured for the LOW SPEED ARINC 429 output data. If the system is configured for High Speed and the other interfaces will not allow the system to be reconfigured to Low Speed, then we will not interface with this particular system. Our software will not work with their Navigation Management Unit NMU P/N 14141-0240 or P/N 14141-0345.

SERVICE MEMO

SECTION I: PLANNING INFORMATION

- A. **EFFECTIVITY:** Stormscope model WX1000E.
- B. **REASON:** To upgrade Navaid Display software in the WX1000E Stormscopetm Processor for expanded Loran/GPS interface capabilities. The added system interfaces are: BFG FlightSystems LNS616B, LNS6000, ARNAV R50i, Apollo 800, GARMIN GPS-100, Trimble TNL2100, TNC3100 and Northstar GPS 600.
NOTE! Interface to the Apollo NMC-2001 is a FACTORY MOD ONLY to the WX1000E Processor.
- C. **COMPLIANCE:** Optional.
- D. **DESCRIPTION:** Remove six IC chips and replace them with software version 3.21.
- E. **APPROVAL:** Factory.
- F. **MANPOWER:** 1.0 Hrs.
- G. **MATERIAL:** Modification Kit P/N 78-8051-9161-2
- H. **EQUIP:** Standard Series II test set-up.
- I. **WT. & BAL:** Not affected
- J. **ELECT. LOAD:** Not affected
- K. **SOFTWARE:** Software version goes to version 3.21
- L. **REFERENCES:** WX1000 Instruction Manual.
- M. **PUBS AFFECT:** Instruction Manual.

SECTION II: ACCOMPLISHMENT INSTRUCTIONS

A. MODIFICATION PROCEDURE:

1.) Removal

CAUTION: As with any equipment using CMOS technology, a grounding strap and insulated work space is recommended. IC pins should not be touched unless necessary.

- a) Reference Figure 1: Remove five Phillips head screws at the front of the processor unit.
- b) Pull the face plate straight forward. Lay this face plate aside for later reinstallation.
- c) Using the extractor tabs, remove the three circuit cards by pulling straight out. The top card is the Analog Board, the center board is the Digital Board, and the bottom one is the Expansion Board.

2.) Modification.

- a) Install new software on the Analog Board by identifying EPROMs U801 and U802. Replace these with the version 3.21 EPROMs which bear the same reference designators. Correct orientation of these EPROMs is with the key toward the connector of the circuit card. Reference Figure 2.
- b) Install new software on the Digital Board by identifying EPROMs U705 and U706. Replace these with the version 3.21 EPROMs which bear the same reference designators. All new EPROMs will also have WX-1000+ printed on them. Correct orientation of these EPROMs is with the key toward the center of the circuit card. Reference Figure 3.
- c) Install new software on the Expansion Board by identifying EPROMs U605 and U606. Replace these with the version 3.21 EPROMs which bear the same reference designators. All new EPROMs will also have WX-1000+ printed on them. Correct orientation of these EPROMs is with the key toward the center of the circuit card. Reference Figure 4.

- d) Reinstall these circuit boards into the housing, seating them firmly in their connector socket.

3.) REASSEMBLY.

- a) Reassemble the processor face plate.
- b) Replace the five Phillips screws removed during disassembly.

B. TESTING PROCEDURE:

- 1) Perform Navaid Setup page 5-13 and normal bench check procedure page 5-15 in the WX1000 Instruction Manual.

C. IDENT:

- 1) Remove the software ID tag on the rear of the processor and replace it with the new tag provided. Reference Figure 5.

SECTION III: MATERIAL INFORMATION

A. PARTS

DELETED:	U605	P/N	78-8060-5932-1	ver. 3.00→3.20
	U606	P/N	78-8060-5933-9	ver. 3.00→3.20
	U705	P/N	78-8060-5778-8	ver. 3.00→3.20
	U706	P/N	78-8060-5779-6	ver. 3.00→3.20
	U801	P/N	78-8060-5782-0	ver. 3.00→3.20
	U802	P/N	78-8060-5783-8	ver. 3.00→3.20
	Tag	P/N	78-8060-5767-1	ver. 3.00→3.20

B. PARTS

ADDED:	U605	P/N	78-8060-5932-1	ver. 3.21
	U606	P/N	78-8060-5933-9	ver. 3.21
	U705	P/N	78-8060-5778-8	ver. 3.21
	U706	P/N	78-8060-5779-6	ver. 3.21
	U801	P/N	78-8060-5782-0	ver. 3.21
	U802	P/N	78-8060-5783-8	ver. 3.21
	Tag	P/N	78-8060-5942-0	ver. 3.21

SECTION IV: ILLUSTRATIONS

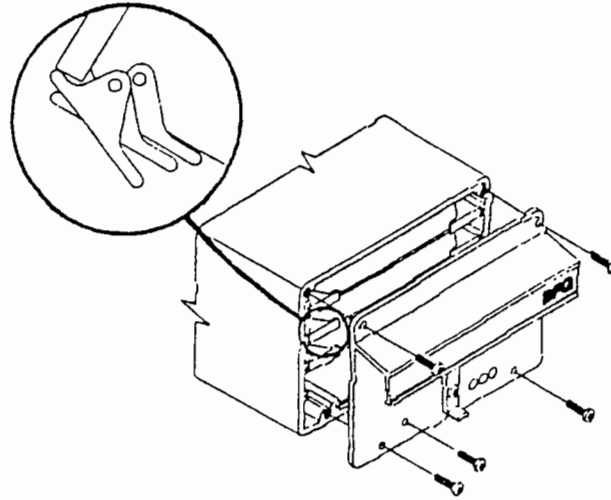


Figure 1 Front view of processor.

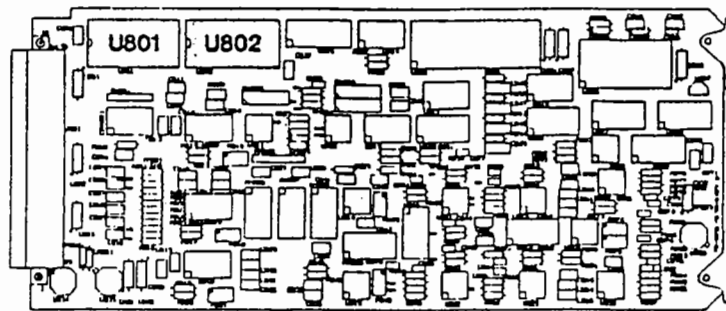


Figure 2 Analog Board.

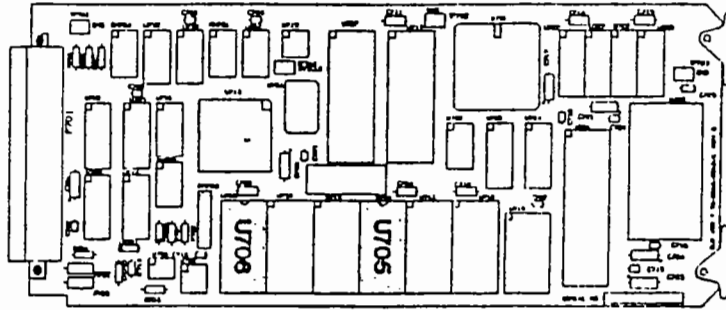


Figure 3 Digital Board.

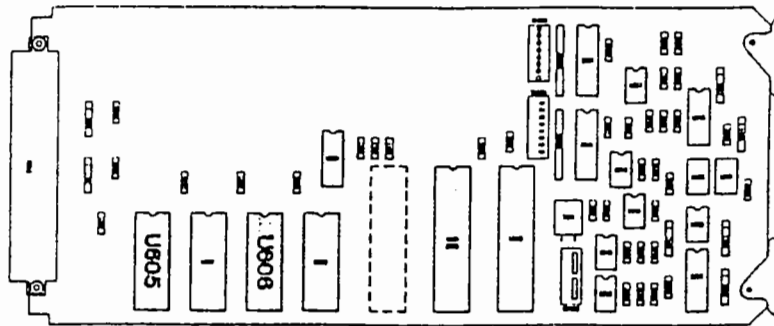
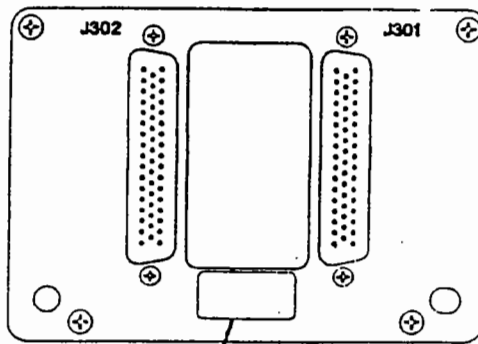


Figure 4 Expansion Board.



Software Version Label

Figure 5 Software Tag Location.

LIST OF EFFECTIVE PAGES

Date of original and changed pages are:

Original	21 January 1993
Change 1	9 April 1993
Change 2	30 September 1993
Change 3	7 October 1994

NOTE

The portion of the text affected by the change is indicated by a vertical line in the outer margins of the page. Changes to illustrations (other than diagrams and schematics) are identified with a miniature pointing hand. Shading is used to highlight the area of diagrams and schematics containing a change.

Total number of pages in this publication consists of the following:

Page No.	Change No.
Title Page	3
A Page	3
i	3
ii thru v	0
vi	3
1-1 thru 1-3	3
1-4 thru 1-15	0
1-16	3
1-17	0
1-18	2
1-19 thru 1-20	0
2-1 thru 2-30	0
3-1 thru 3-34	0
4-1 thru 4-2	0
5-1 thru 5-54	0
6-1	0
6-2 thru 6-4	3
A-1	0
A-2 thru A-3	3
A-4	1
A-5 thru A-8	3
B-1	0
B-2 thru B-4	3
B-7	0
B-8	3
C-1	0
C-2 thru C-12	3

INSERT LATEST CHANGED PAGES, DESTROY SUPERSEDED PAGES.

Those responsible for maintaining this publication should ensure that all previous changes have been received and incorporated.

This page intentionally left blank.

TABLE OF CONTENTS

Chapter 1
GENERAL INFORMATION

Paragraph	Page
1.1 INTRODUCTION.....	1-1
1.2 FUNCTIONAL DESCRIPTION.....	1-1
1.2.1 General.....	1-1
1.2.2 Features.....	1-2
1.3 PHYSICAL DESCRIPTION.....	1-4
1.3.1 System.....	1-4
1.3.2 Display.....	1-5
1.3.3 Processor.....	1-6
1.3.4 Antenna.....	1-8
1.4 SYSTEM SPECIFICATIONS FOR MODELS WX-1000 AND WX-1000+.....	1-10
1.4.1 Physical Dimensions.....	1-10
1.4.2 Weight.....	1-10
1.4.3 Power Requirements.....	1-10
1.4.4 Inputs/Outputs.....	1-11
1.4.5 Performance Criteria.....	1-15
1.5 EQUIPMENT REQUIRED.....	1-17
1.5.1 Supplied by BFG FlightSystems (Stormscope Series II System).....	1-17
1.5.2 Not Supplied by BFG FlightSystems.....	1-18
1.6 INSTALLATION APPROVAL.....	1-19
1.7 WARRANTY.....	1-20
1.8 PERIODIC MAINTENANCE.....	1-20

Chapter 2
INSTALLATION

2.1 INTRODUCTION.....	2-1
2.2 UNPACKING AND INSPECTION.....	2-1
2.3 BENCH TEST.....	2-1
2.3.1 Checklist Programming.....	2-1
2.4 ANTENNA LOCATION.....	2-2
2.4.1 Interference Sources.....	2-6
2.4.2 Skin Current.....	2-6
2.4.3 Skinmapping.....	2-6
2.4.4 Ground Plane.....	2-6
2.4.5 Alignment.....	2-7
2.4.6 Slipstream.....	2-7
2.4.7 Site Selection.....	2-7
2.5 ANTENNA DOUBLER INSTALLATION.....	2-8
2.6 PROCESSOR LOCATION.....	2-10
2.6.1 Cable Length.....	2-10
2.6.2 Pressurized Aircraft.....	2-10
2.6.3 Orientation.....	2-10
2.6.4 Cooling.....	2-10
2.6.5 Antenna Proximity.....	2-10

TABLE OF CONTENTS
(Continued)

Chapter 2
INSTALLATION
(Continued)

Paragraph	Page
2.6.6 Site Selection	2-10
2.7 PROCESSOR TRAY INSTALLATION	2-10
2.7.1 Preparation	2-10
2.7.2 Installation	2-11
2.8 DISPLAY LOCATION	2-11
2.8.1 Magnetic Effect	2-11
2.8.2 Panel Depth	2-12
2.8.3 Viewing Angle	2-12
2.8.4 Cooling	2-12
2.8.5 Site Selection	2-12
2.9 DISPLAY PANEL CUTOUT	2-12
2.10 CABLE REQUIREMENTS	2-13
2.10.1 Antenna Cable	2-14
2.10.2 Display Cable	2-15
2.10.3 Synchro Cable (WX-1000+ only)	2-16
2.10.4 Navaid Cable (WX-1000+ only)	2-16
2.10.5 Vendors	2-17
2.11 CABLE ROUTING	2-18
2.11.1 Antenna Cable Routing	2-18
2.11.2 Display Cable Routing	2-18
2.11.3 Synchro Cable Routing (WX-1000+ only)	2-18
2.11.4 Power Cable Routing	2-18
2.11.5 Navaid Cable Routing	2-19
2.11.6 ARINC-429 Cable Routing	2-19
2.11.7 Inhibit Line	2-19
2.12 CONNECTOR INSTALLATION	2-20
2-12.1 Connectors	2-20
2.12.2 Wire Color Codes	2-20
2.12.3 Shields	2-20
2.12.4 Cable Termination	2-20
2.12.5 Cable Installation Checkout	2-21
2.12.6 Processor Connector Mounting	2-21
2.12.7 Cable Preparation	2-21
2.12.8 Strain Relief	2-21
2.12.9 Synchro Connections (WX-1000+ only)	2-22
2.12.10 Installation of Option Jumpers	2-22
2.13 ANTENNA INSTALLATION	2-23
2.13.1 Curvature Compensation	2-23
2.13.2 Antenna Mounting and Sealing	2-24
2.14 PROCESSOR INSTALLATION	2-24
2.15 DISPLAY INSTALLATION	2-25
2.16 PERFORMANCE TEST	2-26
2.17 PAPERWORK REQUIREMENTS	2-26

TABLE OF CONTENTS
(Continued)

Chapter 3
OPERATION

Paragraph	Page
3.1 INTRODUCTION.....	3-1
3.2 CONTROLS	3-2
3.3 INDICATORS	3-3
3.3.1 Display	3-3
3.3.2 Processor	3-4
3.4 OPERATION	3-5
3.4.1 Self-Test	3-5
3.4.2 Main Menu.....	3-6
3.4.3 360 Degree Weather Mapping Mode.....	3-7
3.4.4 120 Degree Weather Mapping Mode.....	3-8
3.4.5 Checklist Mode	3-9
3.4.6 TIME/DATE Mode.....	3-11
3.4.7 Options Mode.....	3-12
3.4.8 Navaid Setup Mode	3-15
3.4.9 Navaid Display	3-17
3.4.10 Special Power-Up Modes (Software Versions 1.21 and Lower)	3-19
3.5 SERVICE MENU (SOFTWARE VERSION 2.00 AND HIGHER)	3-20
3.5.1 System Data Mode	3-22
3.5.2 Fault Log Mode.....	3-23
3.5.3 Noise Tests Mode.....	3-25
3.5.4 Test Disable Mode	3-27
3.5.5 Expansion Data Mode (Navaid Option Installed)	3-28
3.5.6 Expansion Tests Mode (Navaid Option Installed)	3-29
3.5.7 LORAN Setup Mode (Navaid Option Installed)	3-30
3.5.8 LORAN RAW DATA Mode	3-32

Chapter 4
THEORY OF OPERATION

4.1 INTRODUCTION.....	4-1
4.2 ANTENNA	4-2
4.3 PROCESSOR.....	4-2
4.4 DISPLAY.....	4-2

TABLE OF CONTENTS
(Continued)

Chapter 5
MAINTENANCE

Paragraph	Page
5.1 INTRODUCTION.....	5-1
5.2 PERIODIC MAINTENANCE.....	5-1
5.3 BENCH TEST.....	5-1
5.3.1 Equipment Required.....	5-1
5.3.2 Self-Test Disable.....	5-2
5.3.3 Bench Setup.....	5-4
5.3.4 Bench Test Procedure.....	5-13
5.3.5 Fault Isolation.....	5-16
5.4 ADDITIONAL GROUND TESTS.....	5-17
5.4.1 Continuous Out Test.....	5-17
5.4.2 Circular Test.....	5-19
5.4.3 Storm Simulation Test.....	5-20
5.4.4 WX-PA Output Verification Test.....	5-20
5.5 ADJUSTMENTS.....	5-20
5.6 CHECKLIST ENTRY.....	5-22
5.7 PERFORMANCE TEST.....	5-24
5.7.1 Equipment Required.....	5-25
5.7.2 Options Jumpers.....	5-25
5.7.3 Performance Test Procedures.....	5-25
5.8 TROUBLESHOOTING.....	5-37
5.8.1 Troubleshooting Chart.....	5-37
5.8.2 Error Messages.....	5-39
5.8.3 Connector Pin-Outs.....	5-42
5.8.4 Troubleshooting Electrical Noise.....	5-46
5.9 REPAIRS.....	5-51
5.9.1 Stormscope System.....	5-51
5.9.2 WX-PA Portable Analyzer.....	5-51
5.9.3 Loaner/Exchange Component.....	5-52
5.10 UPGRADES AND OPTIONS.....	5-52
5.11 PRODUCT WARRANTY.....	5-53
5.11.1 Warranty Statement.....	5-53
5.11.2 Related Policies and Procedures.....	5-53

Chapter 6
ILLUSTRATED PARTS BREAKDOWN

6.1 Stormscope SYSTEM.....	6-1
6.2 HARDWARE PACKAGE.....	6-3

APPENDIX A

Stormscope Series II/Loran Interface.....	A-1
---	-----

APPENDIX B

Stormscope Series II/ARINC-429 EFIS Option.....	B-1
---	-----

APPENDIX C

Stormscope Series II/ARINC-429 Navaid Option.....	C-1
---	-----

LIST OF ILLUSTRATIONS

Figure	Page
1-1	Display Outline 1-5
1-2	Processor Outline 1-6
1-3	Processor Tray Outline 1-7
1-4	Antenna Outline..... 1-8
1-5	Antenna Doubler Plate Outline 1-9
1-6	Heading Valid Excitation 1-12
1-7	Flag Action Table 1-12
1-8	Suggested King KCS55 Flag Interface 1-13
1-9	Cable Vendors Table 1-18
2-1	Typical Antenna Locations 2-3
2-2	Exceptions to Typical Antenna Locations 2-4
2-3	More Exceptions to Typical Antenna Locations 2-5
2-4	Antenna Mounting Holes..... 2-8
2-5	Antenna Doubler Installation 2-9
2-6	Processor Mounting Holes 2-10
2-7	Processor Tray Installation 2-11
2-8	Display Panel Cutout and Mounting Holes..... 2-12
2-9	Antenna Cable Specification 2-14
2-10	Display Cable Specification 2-15
2-11	Synchro Cable Specification 2-16
2-12	Cable Vendors Table 2-17
2-13	Cable Preparation 2-21
2-14	WX-1000+ Synchro Connections 2-22
2-15	Option Jumpers Selection Table 2-22
2-16	Antenna Installation..... 2-23
2-17	Display Installation 2-25
2-18	System Overview..... 2-27
2-19	System Interconnect 2-29
3-1	System Operating Controls 3-2
3-2	Information Display 3-3
3-3	Processor Status LED's..... 3-4
3-4	Self-Test Presentation 3-5
3-5	Main Menu Presentation 3-6
3-6	360 Degree Presentation..... 3-7
3-7	120 Degree Presentation..... 3-8
3-8	Checklist Mode Presentation 3-9
3-9	Checklist Item Presentation..... 3-10
3-10	Time/Date Presentation..... 3-11
3-11	Options Presentation 3-13
3-12	System Self-Tests Table..... 3-14
3-13	Navaid Setup Presentation 3-15
3-14	Selected Items "Placed"..... 3-16
3-15	Navaid Display Status..... 3-17
3-16	Navaid Option Data Display 3-18
3-17	LORAN Nav Flag Display 3-18
3-18	Loran Warning Display 3-19
3-19	Service Menu Presentation..... 3-20
3-20	System Data Presentation..... 3-22

LIST OF ILLUSTRATIONS

(Continued)

Figure	Page
3-21	Fault Log Page 1 3-23
3-22	Fault Log Page 2 3-24
3-23	Noise Monitor Presentation..... 3-25
3-24	Test Strike Presentation..... 3-26
3-25	Test Disable Message..... 3-27
3-26	Expansion Data Presentation 3-28
3-27	Expansion Tests - Screen 1..... 3-29
3-28	Expansion Tests - Screen 2..... 3-30
3-29	LORAN Setup Presentation 3-31
3-30	LORAN Parameters Presentation 3-32
3-31	LORAN RAW DATA Presentation..... 3-33
3-32	LORAN RAW DATA Stopped..... 3-34
3-33	LORAN RAW DATA Timeout 3-34
5-1	Skinmapper 5-4
5-2	Skinmap Hookup..... 5-5
5-3	Bench Setup With Antenna..... 5-6
5-4	WX-PA Antenna Alignment 5-8
5-5	WX-PA Control Panel 5-9
5-6	Bench Setup Without Antenna 5-10
5-7	Communications Test Plug..... 5-16
5-8	Continuous Out Test Display 5-18
5-9	Circular Test Display..... 5-19
5-10	Removing Processor Cover 5-21
5-11	Expansion Interface PCB 5-22
5-12	Aircraft Test Setup..... 5-28
5-13	Noise Monitor Presentation..... 5-31
5-14	Test Strike Presentation..... 5-32
5-15	Test Setup Without Antenna..... 5-35
5-16	Troubleshooting Flowchart..... 5-37
5-17	Error Messages..... 5-39
5-18	Display Plug Pin-Out..... 5-42
5-19	Antenna Plug Pin-Out 5-43
5-20	Processor Plug Pin-Out..... 5-44
5-21	Communications Plug Pin-Out 5-45
5-22	Troubleshooting Flowchart..... 5-49
6-1	<i>Stormscope</i> System..... 6-1
6-2	Hardware Package 6-3
A-1	Qualified Loran Pin-Out Table A-5
B-1	System Data Presentation (ARINC-429 Heading Source) B-3
B-2	Expansion Tests - Screen 2 (ARINC-429 Option Installed) B-4
B-3	Expansion Interface PCB (ARINC-429 Adjustments)..... B-6
B-4	ARINC-429 DIP Switch Positions..... B-6
B-5	ARINC-429 Status Bits..... B-8
C-1	ARINC-429 Navaid Pin-Out Table C-2
C-2	Typical ARINC-429 Navaid Data Screen C-3
C-3	Navaid-Related ARINC-429 Labels C-4
C-4	Expansion Tests - Screen 2 (ARINC-429 Navaid Option Installed)..... C-6
C-5	Expansion Interface PCB (ARINC-429 Navaid Adjustments)..... C-8
C-6	ARINC-429 DIP Switch Positions..... C-8

CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains descriptions, specifications, installation instructions, and maintenance procedures for the Model WX-1000 and Model WX-1000+ *Stormscope* Series II Weather Mapping Systems. Additional information is provided for the Navaid Option (Appendix A), ARINC-429 EFIS Option (Appendix B) and the ARINC-429 Navaid Option (Appendix C). These options can be installed into a WX-1000+ system. A WX-1000+ model with an option installed becomes a model WX-1000E. The WX-1000E models include all of the features of the WX-1000+ system in addition to the option features. Only one option can be installed for each *Stormscope* system.

All information in this manual pertains to both basic *Stormscope* Series II Models (WX-1000 and WX-1000+), unless otherwise specified. Information unique to the options (the three WX-1000E models) is provided in the Appendices of this manual.

This manual is intended to be used only by BFGoodrich FlightSystems authorized avionics and maintenance personnel, and contains all available technical information relating to the WX-1000, WX-1000+, and WX-1000E *Stormscope* models.

1.2 FUNCTIONAL DESCRIPTION

1.2.1 General

The *Stormscope* Series II Models WX-1000/WX-1000+ are patented thunderstorm detection systems designed for airborne use. Each system maps electrical discharge activity (lightning) 360 degrees around the aircraft to a distance of 200 nautical miles. They comply with F.A.A. TSO-C110a in the USA, and are approved by major government regulatory agencies outside the United States.

In addition to thunderstorm information, the Series II systems also provide electronic checklists which may be customized by an authorized dealer for a specific customer.

The model WX-1000+ has the additional capability of being connected to an external analog synchro (gyro) heading source. This enables the system to display aircraft heading and maintain proper storm display orientation during turns. With the Navaid Option, the WX-1000+ can use inputs from a Loran or Global Positioning System (GPS) receiver to display selected navigational data.

NOTE

All references to Loran in relation to the Navaid Option in this manual, also apply to qualified GPS units. When "Loran" is mentioned, it can be considered "Loran/GPS." This will gain greater significance as more GPS receivers are qualified.

1.2.2 Features**A. WX-1000/WX-1000+**

1. Completely passive system requiring no transmitter.
2. Four selectable ranges with a 200 nautical mile maximum range.
3. Plots vertically oriented intra-cloud, inter-cloud and cloud-to-ground electrical discharge activity.
4. Selectable storm display format with either 360 degree surrounding view or 120 degree forward sector view.
5. Electrical discharge information, acquired and stored on all ranges and all views simultaneously.
6. Up to six dealer-programmable electronic checklists with a maximum of 30 lines each.
7. Real-time digital clock display to provide time-of-day and date.
8. Stopwatch for timed events.
9. Elapsed timer which remembers its count in the absence of power.
10. FLAG advisory displayed if the heading source (gyro) malfunctions (WX-1000+ only).
11. Digital heading display if a heading flag condition is not detected (WX-1000+ only)
12. Heading-stabilized weather display that remains oriented to the aircraft as it turns (WX-1000+ only).
13. High-resolution multi-purpose CRT.
14. Automatic and pilot-initiated self-test programs.
15. Self-diagnostics with error messages.
16. CLEAR function on weather screens to aid in determining whether a thunderstorm is building or dissipating.
17. Extra processor card slot and I/O connector to allow for the addition of BFG FlightSystems expansion circuit boards, including the Navaid Option. (WX-1000+ only)
18. Installation options selectable by jumpers on the processor connector.
19. Meets all requirements of RTCA/DO-191 Minimum Operational Performance Standards for Airborne Thunderstorm Detection Equipment.
20. Meets requirements of RTCA/DO-160B Environmental Conditions and Test Procedures for Airborne Equipment.
21. Meets RTCA/DO-178A level 2.
22. Exceeds system mean time between failure (MTBF) of 2000 hours (calculated using MIL-HDBK-217E).
23. Satisfies the USA requirements of F.A.A. TSO C-110a for Thunderstorm Avoidance Systems.
24. Approved by major government regulatory agencies outside the USA.
25. WX-1000 to WX-1000+ upgrade with the addition of a circuit card and software change.

B. WX-1000+ with Navaid Option (Appendix A)

1. Maintains all of the features of the standard Series II WX-1000+ Weather Mapping System.
2. Navigational information shown simultaneously on the same display with the weather mapping data.
3. Uncluttered, clearly readable graphics and digital navigational information.
4. Heading stabilized display of course line to selected way point.
5. Fully opto-isolated RS-232C or RS-422 serial communications.
6. Additional fully opto-isolated RS-232C communications port for future expansion functions.
7. Usable with a variety of Loran receivers, with more being added as new models are released.
8. Accepts Global Position System navigational inputs from qualified GPS receivers.

9. User-selectable display of digital navigational data (up to six of the following items), as well as course line, way point, and course deviation indicator (CDI) information.
 - a. Range to Active Way point
 - b. Ground Speed
 - c. Estimated Time Enroute
 - d. Bearing of Active Way point
 - e. Cross Track Error
 - f. Estimated Time of Arrival
 - g. Current Track
 - h. Active Way point Identifier
 - i. Magnetic Variation at Present Position
 - j. Minimum Safe Altitude
 - k. Minimum Enroute Safe Altitude
 - l. Digital Stopwatch/Timer
 - m. Current Latitude
 - n. Current Longitude
10. Display of flight plan course lines and way points when connected to an appropriate Loran or GPS receiver.
11. Display of position error warnings and a Loran nav flag.
12. Internal power-on and user-initiated self-test to ensure valid system operation.
13. Meets all requirements of RTCA/DO-160B Environmental Conditions and Test Procedures for Airborne Equipment.
14. Exceeds system mean time between failure (MTBF) of 2,000 hours (calculated using MIL-HDBK-217E).
15. Software that meets all requirements of RTCA/DO-178A Software Considerations in Airborne Systems and Equipment certification.
16. Meets F.A.A. requirements of TSO C-110a for Thunderstorm Avoidance Systems.

C. WX-1000+ with ARINC-429 EFIS Option (Appendix B)

1. Internal power on self-test to insure valid system operation.
2. Can be used simultaneously with a standard (optional) WX-1000+ CRT display.
3. Simultaneous transmission of location and intensity information for up to 63 areas of thunderstorm activity on a single display.
4. User-selected low or high speed ARINC-429 data transmission rate.
5. User-selected low or high speed ARINC-429 input port for reception of ARINC-429 data.
6. ARINC-429 heading source may be used instead of XYZ source.
7. Meets all requirements of RTCA/DO-160B Environmental Conditions and Test Procedures for Airborne Equipment.
8. Exceeds system mean time between failure (MTBF) of 2000 hours (calculated using MIL-HDBK-217E).
9. Software meets requirements of RTCA/DO-178A Software Considerations in Airborne Systems and Equipment Certification.

D. WX-1000+ with ARINC-429 Navaid Option (Appendix C)

1. Maintains all features of standard Series II WX-1000+ Weather Mapping System.
2. Provides capability to receive navigation data in the ARINC-429 data format.
3. User-selected navigation items for display.
4. Displays navigation data simultaneously with real-time thunderstorm data.

1.3 PHYSICAL DESCRIPTION

1.3.1 System

The *Stormscope* Series II WX-1000/WX-1000+ systems consist of three main components: processor, display and antenna. The WX-1000 components are identical to those of the WX-1000+, with the exception of the processor.

A. Processor (one of the following):

- WX-1000 P/N 78-8060-5790-3
- WX-1000+ P/N 78-8051-9160-4
- WX-1000E P/N 78-8060-5941-2 (WX-1000+ with Navaid Option)
- WX-1000E P/N 78-8060-6086-5 (WX-1000+ with ARINC-429 EFIS Option)
- WX-1000E P/N 78-8060-6092-3 (WX-1000+ with ARINC-429 Navaid Option)

B. Display:

P/N 78-8060-5900-8

C. Antenna:

P/N 78-8051-9200-8

D. Expansion Interface PCB (installed in processor):

- P/N 78-8060-5894-3 (Navaid Option)
- P/N 78-8060-5919-8 (ARINC-429 EFIS Option)
- P/N 78-8060-6101-2 (ARINC-429 Navaid Option)

1.3.2 Display

The display is a 3ATI (Air Transport Indicator) unit which mounts in the instrument panel and does not require a mounting tray.

The display component houses the CRT and the pilot's operating controls. All connections to the display are made through a single 25 pin D-subminiature connector on the back panel. Figure 1-1 depicts the display outline.

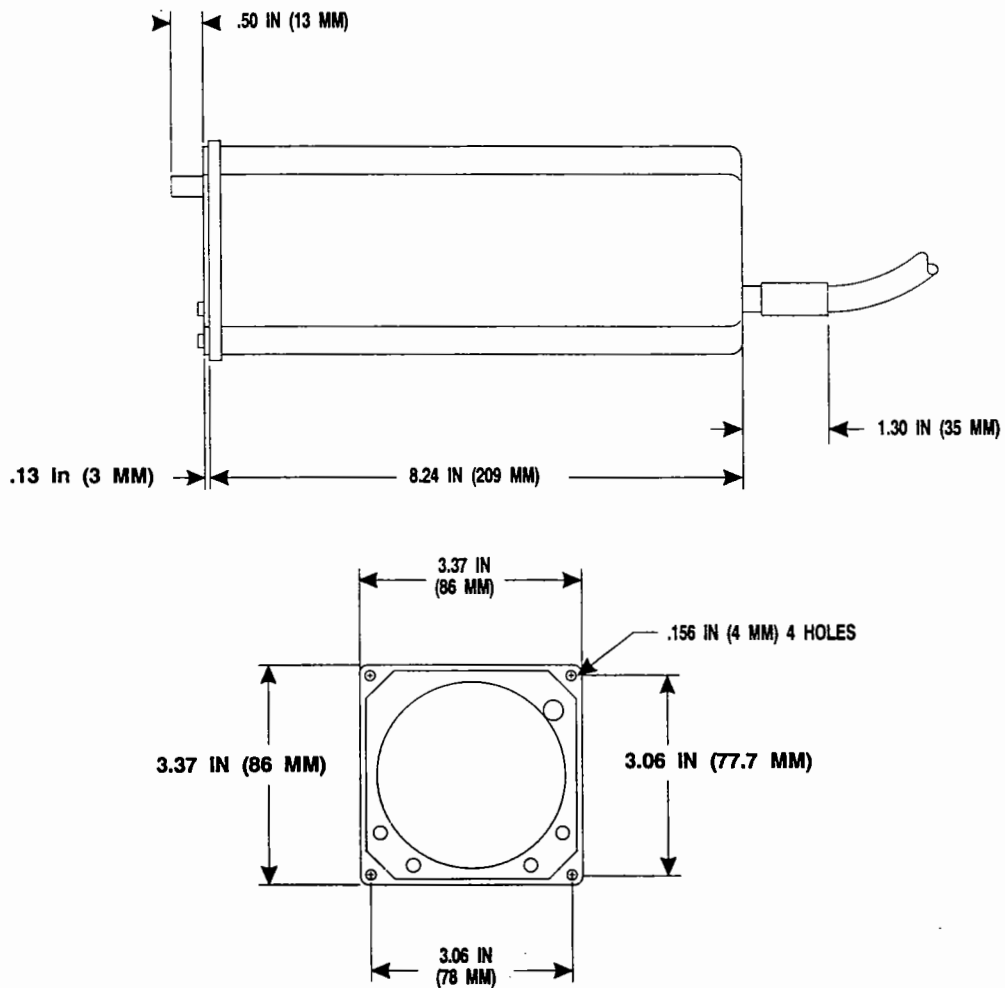
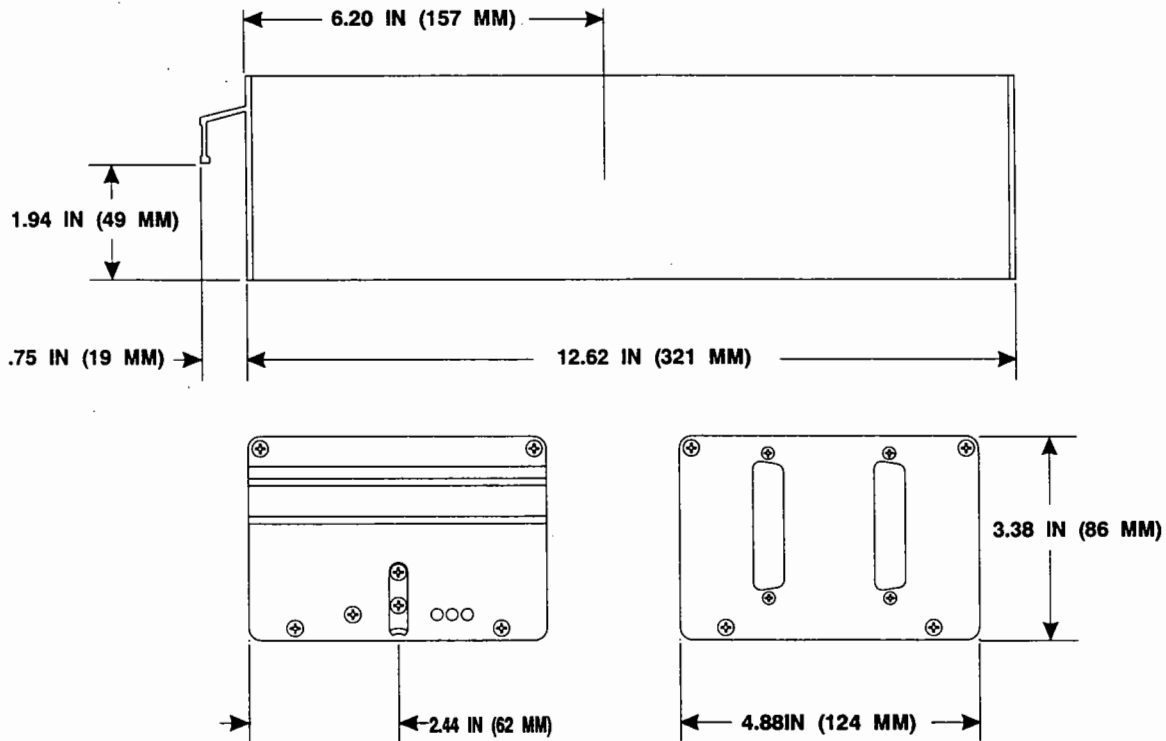


Figure 1-1. Display Outline

1.3.3 Processor

The processor is a 1/2 short dwarf ATR (Austin Trumbull Radio Racking) unit which is remotely mounted in the aircraft.

The processor contains all system processing and control circuitry. Connections are made through a 50 pin D-subminiature connector on the back panel. An additional 50 pin connector is provided on the back panel for option jumpers and for use with BFG FlightSystems expansion boards. Figure 1-2 depicts the processor outline.



Notes:

1. Tolerance: $\pm .02$ IN (± 0.5 MM) unless noted.
2. Connector: Two 50 pin D subminiature with interlock to processor tray.
(Part Number: 78-8051-9180-2)

Figure 1-2. Processor Outline

Figure 1-3 depicts the processor mounting tray.

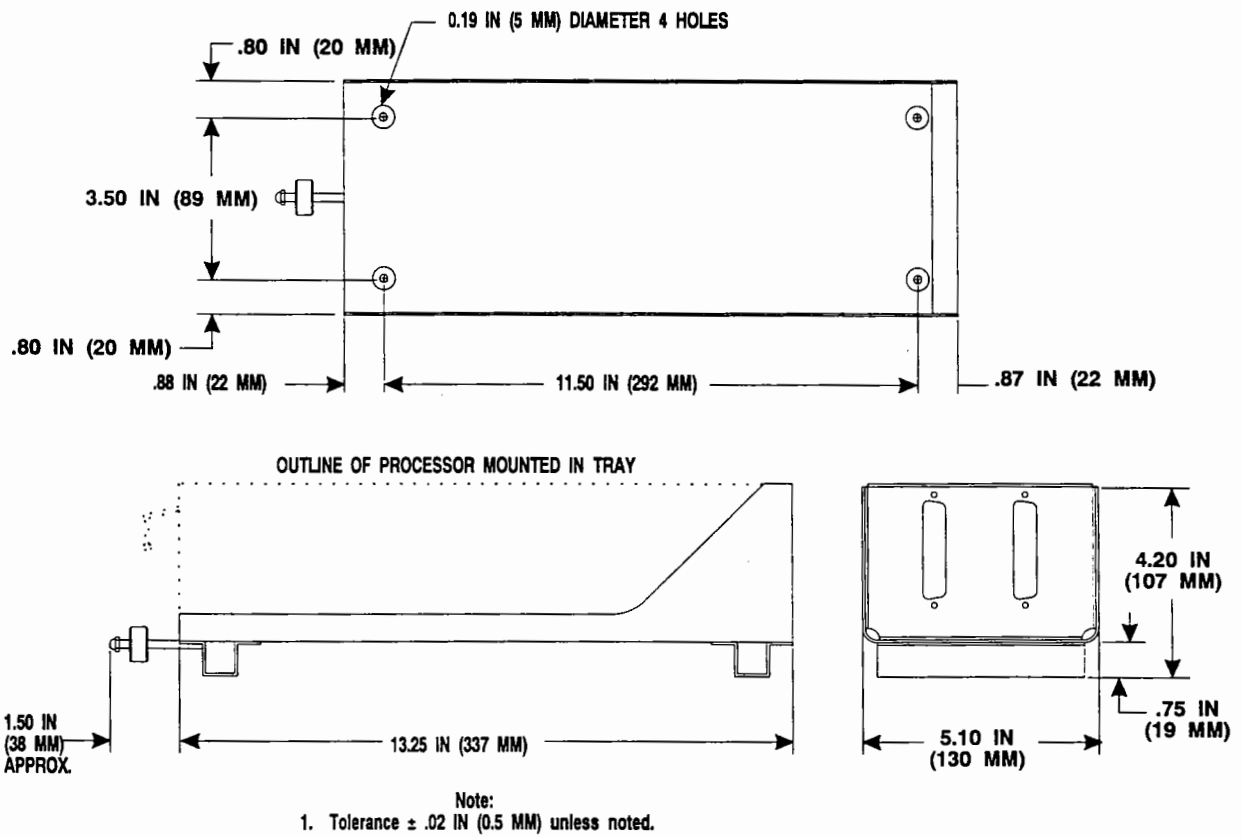


Figure 1-3. Processor Tray Outline

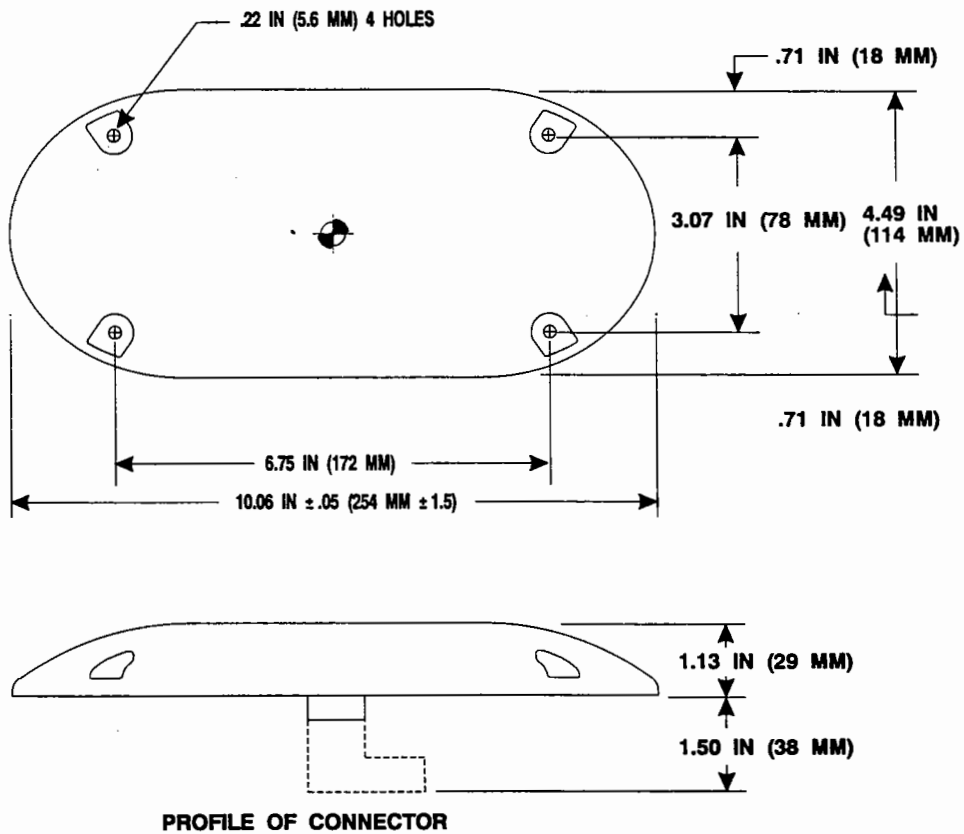
1.3.4 Antenna

The antenna is an aerodynamically-shaped, combined crossed-loop and sense antenna, incorporating internal active circuitry. Mounting is external to the aircraft and connections are made through a 19 pin Cannon connector. The antenna is sealed against environmental extremes and is non-repairable.

CAUTION

Do not paint the antenna! Painting the antenna may cause system failure and will void the warranty!

Figure 1-4 depicts the antenna outline.



- Notes:**
1. Tolerance: $\pm .02$ in (± 9.5 MM) unless noted.
 2. Connector: 19 pin circular per MIL-C-26482.

Figure 1-4. Antenna Outline

Figure 1-5 depicts the doubler plate outline.

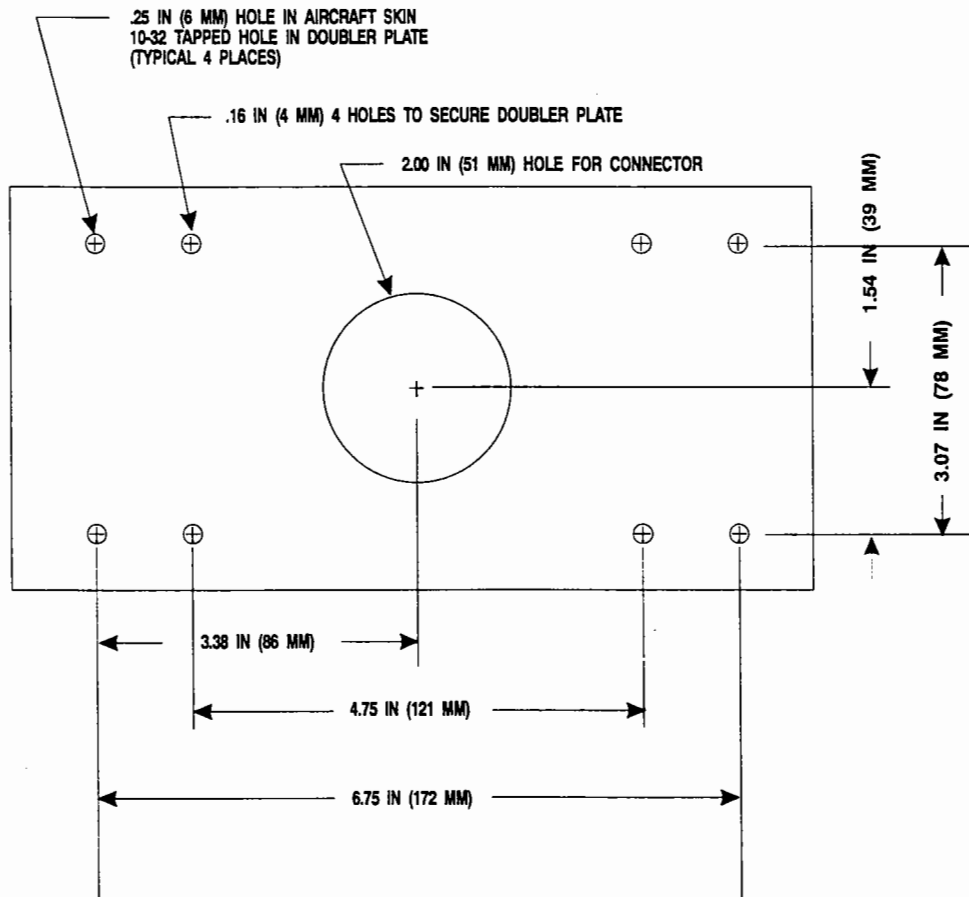


Figure 1-5. Antenna Doubler Plate Outline

1.4 SYSTEM SPECIFICATIONS FOR MODELS WX-1000 AND WX-1000+

1.4.1 Physical Dimensions

A. Display

Height..... 3.37 in. (8.56 cm)
Width..... 3.37 in. (8.56 cm)
Depth..... 8.24 in. (20.92 cm)

B. Processor

Height..... 3.38 in. (8.59 cm)
Width..... 4.88 in. (12.40 cm)
Depth..... 12.62 in. (32.05 cm)

C. Antenna

Height..... 1.13 in. (2.87 cm)
Width..... 4.49 in. (11.40 cm)
Length 10.06 in. (25.60 cm)

1.4.2 Weight

A. Display 2.28 lbs..... (1.03 kg)
B. Processor
 (with tray) 6.67 lbs. (3.02 kg)
 (with Navaid)..... 7.17 lbs. (3.25 kg)
 (with ARINC-429)..... 7.17 lbs. (3.25 kg)
C. Antenna 2.00 lbs. (0.91 kg)
D. Total System
 (with expansion board)..... 11.45 lbs. (5.19 kg)

1.4.3 Power Requirements

A. Input Voltage 10.5 to 32.0 VDC
B. Power Consumption..... 28W
C. Circuit Breaker
 14V 4A
 28V 2A

1.4.4 Inputs/Outputs

A. Inhibit control

This input is connected to the switch on the microphone of the aircraft's communications transmitter. When the transmitter is active, strike processing is disabled to prevent transmitted signals from interfering with the storm data.

1. Active
Min: 0.0V
Max: 0.7V

2. Inactive
Min: 2.4V
Max: 28.0V

B. Synchro connections (WX-1000+ only)

These input connections from the aircraft heading source enable the unit to rotate the displayed storm data as the aircraft turns and to display aircraft heading on the screen.

1. X(S1), Y(S3), Z(S2)

Frequency:
400 Hz (60 Hz to 1 KHz)
Impedance:
13K ohms each
Voltage
Min: 5.0V RMS
Max: 35V RMS

2. H and C (high and low reference)

Frequency:
400 Hz (60 Hz to 1 KHz)
Impedance:
30K ohms each
Voltage
Min: 5.0V RMS
Max: 35V RMS

C. Heading Valid - (WX-1000+ only)

This optically isolated input provides heading source status information to the WX-1000+ processor. The WX-1000+ optocoupler input is turned on and off by the "valid" or "flagged" state of the Compass Valid status signal.

The heading Valid excitation circuit is represented in figure 1-6.

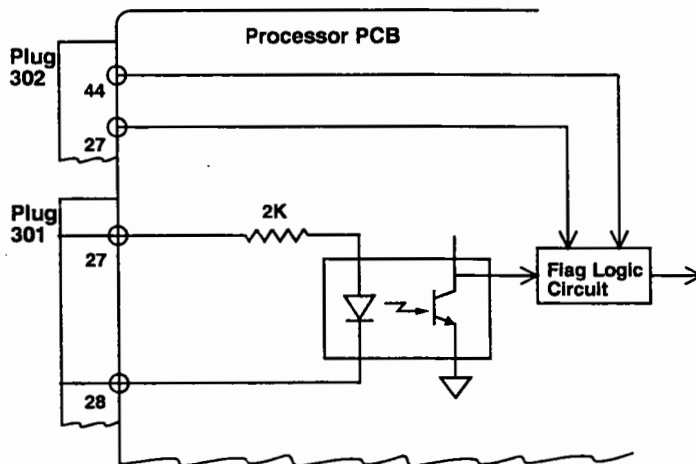


Figure 1-6. Heading Valid Excitation

1. Optocoupler off:

Voltage on P301 Pin 27 (FLAGHI) relative to Pin 28 (FLAGLO) less than + 1.0V (or is reverse biased).

2. Optocoupler energized:

Voltage on P301 Pin 27 (FLAGHI) relative to Pin 28 (FLAGLO) greater than + 5.0V.

For Software Versions 2.00 and higher, flag action can be programmed with a jumper between P302 pins 44 and 27 according to the table in figure 1-7. For Software Versions 1.21 and lower, flag action is as described for jumper open.

Input State	Flag Response	
	P302 44-27 Open	P302 44-27 Jumpered
Optocoupler Energized	Flagged	Valid
Optocoupler Off	Valid	Flagged

Figure 1-7. Flag Action Table

1. Input impedance: 2000 ohms, $\pm 5\%$
2. Max. input voltage: ± 30 VDC.
3. Max. input current: 15mA
4. Min. input current: 1mA

The recommended connection of a navigational system that provides a Valid low signal to the *Stormscope* processor (such as the King KCS55) is shown in figure 1-8. (In this case, pins 44-27 of connector P302 are jumpered.)

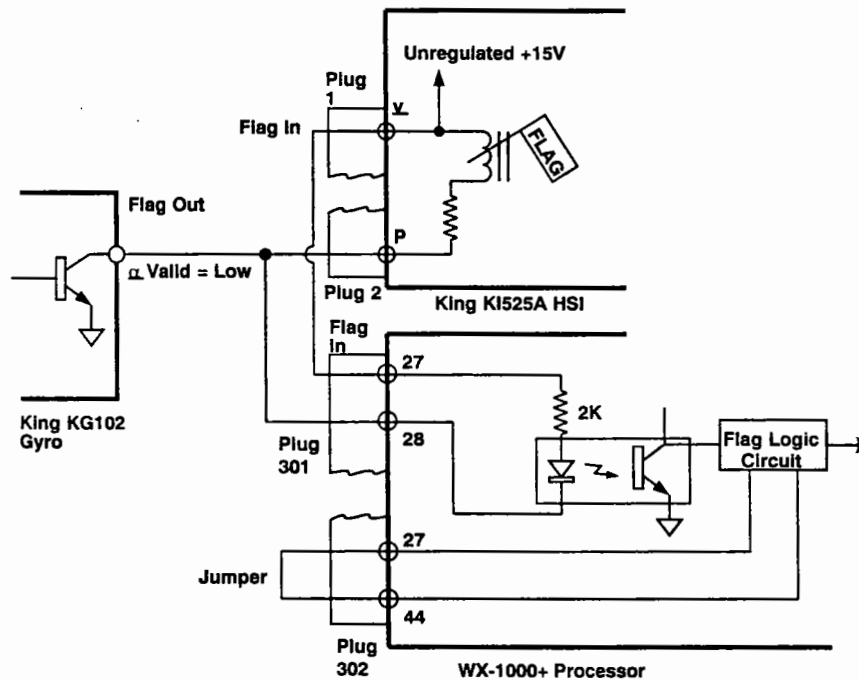


Figure 1-8. Suggested King KCS55 Flag Interface

NOTE

If a heading Valid signal is not connected, do not jumper pins 27-44 of P302.

D. Loran

These signals through P302 provide navigational data from the communication circuits of a qualified Loran for presentation on the display CRT. The Loran connection is through either a standard RS-232C or RS-422 interface. The signals are optically isolated to prevent ground loops. There is a fully isolated on-board DC to DC converter to supply the necessary voltages for the interface.

1. RS-232C Transmitted Data (TxD) - Pin 4 (RS232TX1)

Logic 0 (space)

Min: + 5V

Max: + 15V

Logic 1 (mark)

Min: - 5V

Max: - 15V

2. RS-232C Received Data (RxD) - Pin 5 (RS232RX1)

Logic 0 (space)

Min: + 3V

Max: + 15V

Logic 1 (mark)

Min: - 3V

Max: - 15V

3. RS-422 Received Data - Pin 4 (RS422B), Pin 5 (RS422A)

Logic 0 (space)

Min(A-B): + 2V

Max(A-B): + 6V

Logic 1 (mark)

Min(A-B): - 2V

Max(A-B): - 6V

Max current: ± 60 mA

Max short circuit current: ± 180 mA

Input impedance: 12K ohms

4. Ground (circuit common) is on Pin 3 for both the RS-232C and the RS-422.

E. ARINC-429 EFIS (WX-1000+ with ARINC-429 EFIS Option)

These signals through P302 enable the weather mapping data generated by the *Stormscope* system to be displayed with other information on a qualified electronic display system CRT.

429 Receive (+): Pin 34 (429RX1A)

429 Receive (-): Pin 35 (429RX2B)

429 Transmit (+): Pin 38 (429TXA)

429 Transmit (-): Pin 21 (429TXB)

F. Option Select Jumpers

These jumpers are located on the processor auxiliary connector (P302). They allow the WX-1000/WX-1000+ to be configured for specific aircraft installations.

1. Antenna location (Pins 24-41):

Bottom mount - Open

Top mount - Jumpered

2. Cruise Speed (Pins 25-42):

< 225 KIAS - Open

≥ 225 KIAS - Jumpered

3. Synchro Heading Source Connected (WX-1000+ only) (Pins 26-43):

No synchro connected - Open

Synchro connected - Jumpered

4. Flag Action (Pins 44-27):

Refer to Section 1.4.4C and figure 1-7.

1.4.5 Performance Criteria

A. Operational per RTCA/DO-191

The *Stormscope* Series II system is designed to meet all the specifications of RTCA/DO-191 Minimum Operational Performance Standards for Airborne Thunderstorm Detection Equipment.

B. Environmental per RTCA/DO-160B

The *Stormscope* Series II system (antenna, processor, and display) is designed to meet the following specifications of RTCA/DO-160B Environmental Conditions and Test Procedures for Airborne Equipment.

1. Temperature and Altitude

Antenna: DO-160B Category C2
-55 to +70 deg C
55,000 ft. (16,764 meters)

Processor: DO-160B Category C2
-55 to +70 deg C
55,000 ft. (16,764 meters)

Display: DO-160B Category C1
-20 to +55 deg C
35,000 ft (10,668 meters)

2. Humidity (Category A)

Antenna: DO-160B Category A
95% at 50 deg C

Processor DO-16B Category A
95% at 50 deg C

Display DO-160B Category A
95% at 50 deg C

3. Crash Safety Shocks (sustained)

Antenna: DO-160B
15g any axis

Processor: DO-160B
15g any axis

Display: DO-160B
15g any axis

4. **Vibration**

Antenna: DO-160B Standard
Vibration Environment
Random Curve C
Sinusoidal, 3G, 0-2000 Hz

Processor: DO-160B Standard
Vibration Environment
Sinusoidal Combined Curve VNP
Random Curve A

Display: DO-160B Standard
Vibration Environment
Sinusoidal Combined Curve VNP
Random Curve A

5. **Magnetic Effect**

Display: DO-160B Category Z

6. **Power Input**

Processor: DO-160B Categories A & B 12.4 VDC through 30.3 VDC, 50 VDC surge

7. **Voltage Spike**

Processor: DO-160B Category A

8. **Audio Frequency Conducted Susceptibility-Power Inputs**

Processor: DO-160B Category Z

9. **Induced Signal Susceptibility**

Antenna: DO-160B Category Z
Processor: DO-160B Category Z
Display: DO-160B Category Z

10. **Radio Frequency Susceptibility (Radiated and Conducted)**

Antenna: DO-160B Category Z
Processor: DO-160B Category Z
Display: DO-160B Category Z

11. **Emission of Radio Frequency Energy**

Antenna: DO-160B Category Z
Processor: DO-160B Category Z
Display: DO-160B Category Z

C. Software per RTCA/DO-178A level 2

1.5 EQUIPMENT REQUIRED

1.5.1 Supplied by BFG FlightSystems (Stormscope Series II System):

A. Model WX-1000 system P/N 78-8060-5780-4 consisting of:

<u>QTY</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	78-8060-5790-3	Processor
1	78-8060-5900-8	Display
1	78-8051-9180-2	Processor Tray
1	78-8051-9200-8	Antenna
1	78-8051-9208-1	Gasket
1	78-8051-9206-5	Doubler Plate
1	78-8060-5755-6	Hardware Package, Including all connectors and mounting hardware
1	78-8060-5793-7	Owner's Manual Packet

B. Model WX-1000+ system P/N 78-8051-9240-4 consisting of:

<u>QTY</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	78-8051-9160-4	Processor (with or without options)
1	78-8060-5900-8	Display
1	78-8051-9180-2	Processor Tray
1	78-8051-9200-8	Antenna
1	78-8051-9208-1	Gasket
1	78-8051-9206-5	Doubler Plate
1	78-8060-5755-6	Hardware Package, including all connectors and mounting hardware
1	78-8060-5793-7	Owner's Manual Packet

1.5.2 Not Supplied by BFG FlightSystems

A. Circuit Breaker (4 amp for 14V system; 2 amp for 28V system)

B. System Cables

Pre-fabricated cable which meets BFGoodrich FlightSystems specification is currently available by the foot from:

Figure 1-9. Cable Vendors Table

US COMPANY	ANTENNA CABLE P/N	DISPLAY CABLE P/N	SYNCHRO CABLE P/N	NAVAID CABLE P/N
Dallas Avionics 1-800-527-2581 214-320-9776 FAX 214-320-1057	WX-4 (7.28 lbs/ 100 ft)	WX-3 (10.5 lbs/ 100 ft)	WX-5 (6.84 lbs/ 100 ft)	22TG3T14 (2 lbs/100 ft)
Electronic Cable Specialists 414-421-5300 FAX 414-421-5301	3N6711 (12.5 lbs/ 100 ft)	3N6715 (16 lbs/ 100 ft)	3N6607 (7.5 lbs/ 100 ft)	22TG3T14 (2 lbs/100 ft)
A.E. Petsche 817-461-9473 FAX 817-277-2887	TZANT (10.5 lbs/ 100 ft)	TZDIS (13.1 lbs/ 100 ft)	TZGYR (6.84 lbs/ 100 ft)	22TG3T14 (2 lbs/100 ft)
EDMO Distributors 1-800-235-3300 805-295-6689 FAX 1-800-828-0623 FAX 805-295-6703	WX-1000 ANTENNA	WX-1000 DISPLAY	WX-1000 SYNCHRO	22TG3T14
PIC Wire and Cable 1-800-742-3191 414-246-0500 FAX 414-246-0450	WM25811 (11.3 lbs/ 100 ft)	WM25815 (14.5 lbs/ 100 ft)	WM25807 (7.2 lbs/ 100 ft)	22TG3T14 (2 lbs/ 100 ft)
* 22TG2T14 may be used on RS-232 installations, but 22TG3T14 is preferred because it can accomodate both RS-232 and RS-422 instruments.				

NOTE

The additional cable required when installing the Navaid Option to the WX-1000+ Stormscope system conforms to MIL-C-16878/4.

Use of any cable not meeting BFG FlightSystems specifications voids all system warranties, and may be cause for termination of authorized installer status.

C. Antenna Sealant

The antenna must be sealed around the connector opening and around the perimeter of the antenna.

For pressurized aircraft, a sealant meeting MIL-S-8802 shall be used.

For non-pressurized aircraft, non-corrosive RTV such as GE 2567-112 or equivalent may be used.

D. Hand Tools

1. AMP Connectors (processor/display)

Crimp tool - M22520/2-01
with - M22520/2-08 positioner

Insertion/extraction tool - M81969/1-02

2. CANNON Connector (antenna)

Use one of the following:

Crimp tool - M22520/2-01
with - M22520/2-02 positioner

Crimp tool - M22520/1-01
with - M22520/1-02 turret

Insertion tool - MS24256A20

Extraction tool - MS24256R20

Contact the local AMP and ITT CANNON sales representatives for the names of nearby dealers.

E. Display Mooring Clamp (Standard 3ATI) is available from:

MSP, Inc.
R.R.4 - Box 383A
Nashville, IN 47448
812/988-6623, FAX 812/988-6181
MSP P/N 68010-6

The mooring clamp is also available from BFG FlightSystems when ordering the WX-1000/WX-1000+ System. (Specify PN 78-8060-5856-2 when ordering.)

1.6 INSTALLATION APPROVAL

The installation of *Stormscope* Series II systems, if not installed under a type certificate or supplemental type certificate, must be treated as a major alteration on F.A.A. form 337. Application for approval may be made at any F.A.A. Air Carrier, General Aviation, or Flight Standards District Office.

1.7 WARRANTY

The *Stormscope* Series II system is warranted for one year from the date of installation (not to exceed 18 months from the date of shipment from BFG FlightSystems) subject to the limitations outlined in Section 5.11 of this manual.

1.8 PERIODIC MAINTENANCE

Upon delivery of a *Stormscope* Series II system to a customer, the dealer should recommend an annual checkout of the system, especially prior to each thunderstorm season.

CHAPTER 2

INSTALLATION

2.1 INTRODUCTION

This section describes the installation of *Stormscope* Series II Model WX-1000, Model WX-1000+, and Model WX-1000+ with the Navaid Option, in a step by step procedure.

Options available with the WX-1000+ system require the addition of an Expansion Interface printed circuit board (PCB) to the processor. If the original *Stormscope* system purchase included an option, the processor will come with the Expansion Interface board already in place, and this section will provide all the information needed to complete the installation. If an option is being added to a previously installed WX-1000+ system, the system must be returned to the factory or to an Authorized Repair Station (ARS). (This is true for all upgrades.) The return process is the same as that for a system being returned for repair. (See Maintenance Section 5.9, REPAIRS, in this manual.)

A. The installation activities in this section will be performed in the following order:

1. Determine component locations.
2. Install the cables.
3. Install the cable connections.
4. Install the system components.

Refer to the fold-out System Overview diagram (figure 2-18) at the end of this section to see how the components of the system connect.

2.2 UNPACKING AND INSPECTING

Unpack the system carefully and ensure that all parts are present and undamaged. Refer to Section 6 (Illustrated Parts Breakdown) for the parts inventory.

2.3 BENCH TEST

BFG FlightSystems recommends bench testing each *Stormscope* series II system processor, display, antenna and any option(s) immediately upon receipt. (Refer to Maintenance Section 5.3, BENCH TEST.) This verifies proper operation of the system and may save valuable time during installation if hidden damage occurred during shipping. If a problem is found, contact our Product Support Department immediately at (614) 825-2006; FAX (614) 825-2036 in the U.S.A., or an Authorized Repair Station (ARS) outside the country.

2.3.1 Checklist Programming

While bench testing the system, the customer's desired checklists may be entered. The Checklist Worksheets (sample at the end of Maintenance Section 5) simplify this procedure. Enter the aircraft registration number as item one on each of the six checklists, using the Portable Analyzer Test Set (model WX-PA). Refer to the checklist portion of the WX-PA Manual.

NOTE

The aircraft registration number may be entered into the WX-1000/WX-1000+ checklist memory, even if the checklist feature is not used. This relates the checklist to a specific aircraft in the event processors are exchanged between two different types of aircraft.

2.4 ANTENNA LOCATION

The ideal location for the *Stormscope* Series II antenna varies from aircraft to aircraft. However, some typical antenna locations are indicated in Figure 2-1. Antenna locations are indicated by an "A". Known exceptions to these typical locations are indicated in Figures 2-2 and 2-3.

CAUTION

Because of the extended range capability of the Model WX-1000/WX-1000+, antenna placement relative to other active electrical components can be critical. Every effort should be made to conform with the antenna location guidelines contained in this manual, and a skinmap of the aircraft must be performed with the engines and all electrical systems operating prior to every installation.

See Figures 2-2 and 2-3 (Antenna Locations) for known exceptions to these general guidelines.

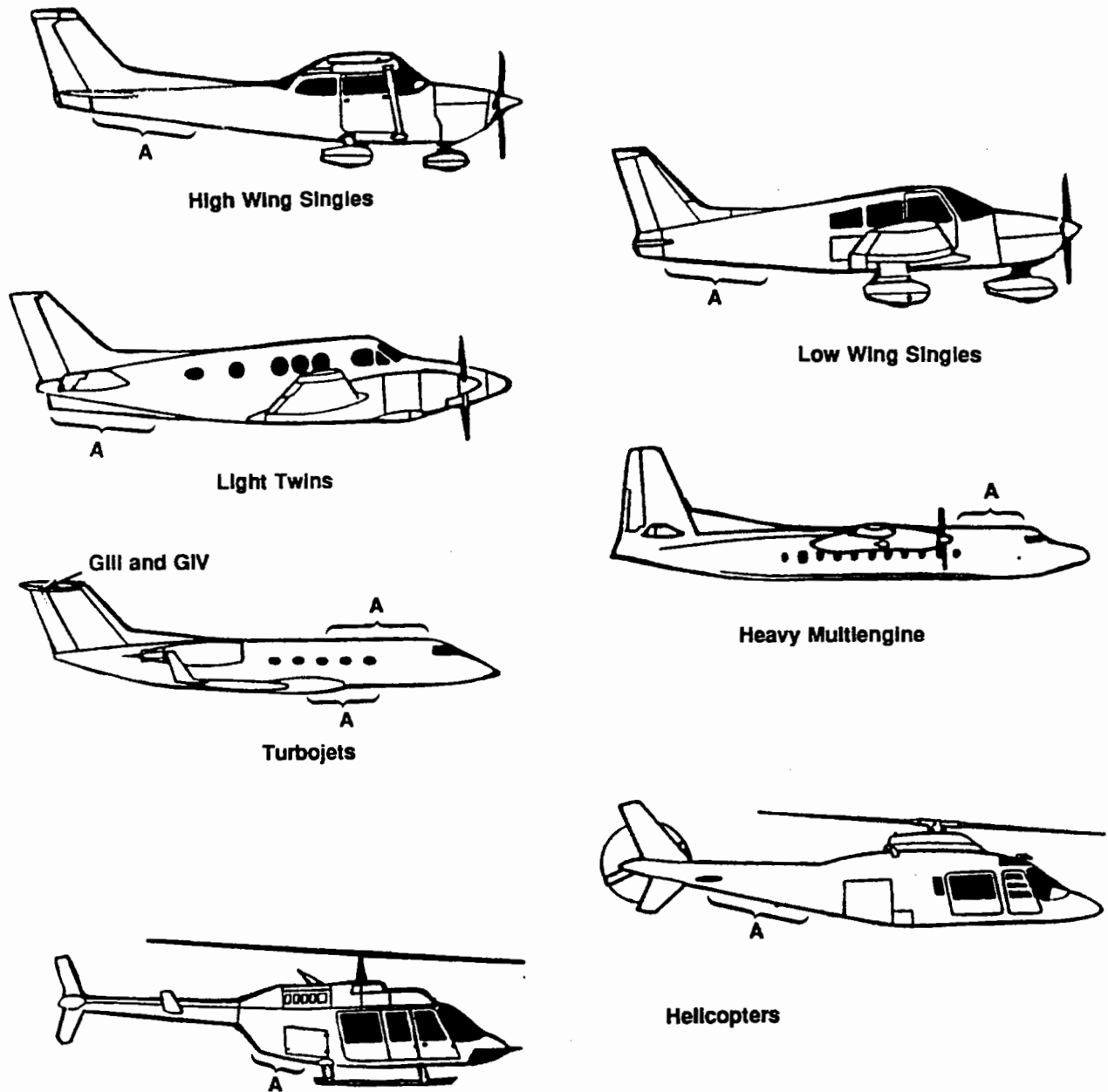
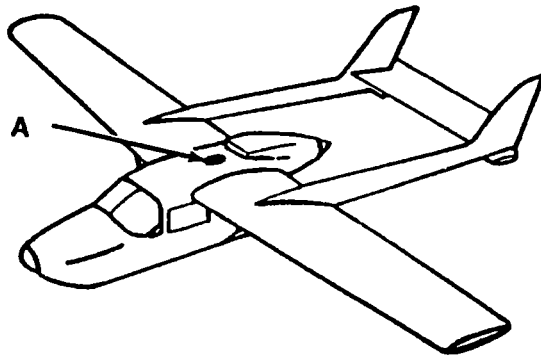
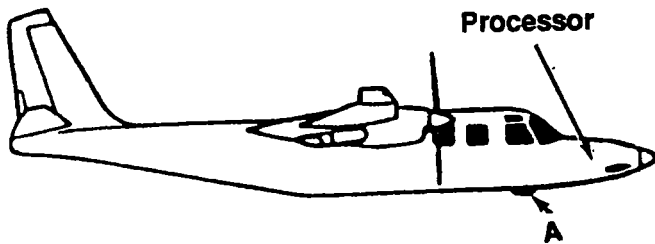


Figure 2-1. Typical Antenna Locations

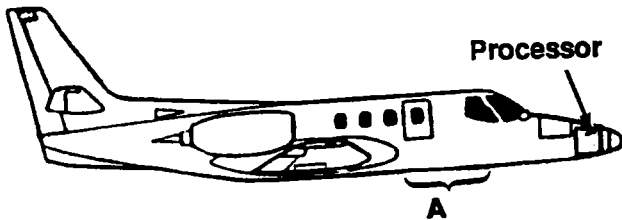


Cessna 337 Skymaster

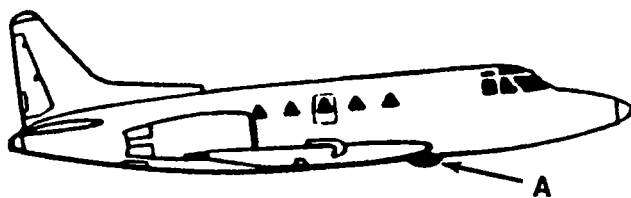
The processor should be mounted in the avionics bay above or under the rear seat.



Rockwell Commander 1000



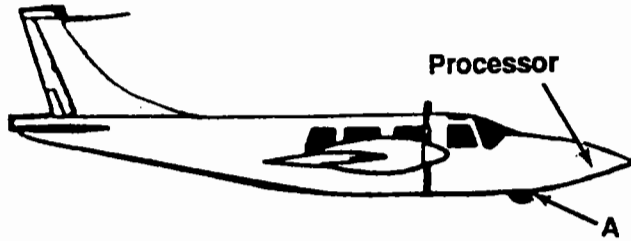
The exact location of the antenna may be anywhere within the bracket shown, and must be verified by a skinmap. (DME or transponder antennas may have to be moved.) The Citation III requires a ground plane over the existing kevlar fairing.



Rockwell Saberliner

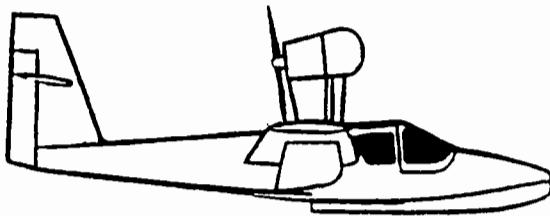
The Antenna should be mounted on the sheet metal panel on the right or left side of the fuselage (at approximately station 190).

Figure 2-2. Exceptions to Typical Antenna Locations



Piper Aerostar

Because of the aft location of the aircraft battery, the antenna must be mounted forward, no more than one foot (0.3 meter) directly behind the nose wheel opening. (DME and transponder antennas must be relocated at least four feet (1.2 meters) away.)



Lake Buccaneer

The antenna mounts on the bottom of the left wing, aft of the wingspar, at wing station 102

Figure 2-3. More Exceptions to Typical Antenna Locations

CAUTION

BFG FlightSystems strongly discourages *Stormscope* installations in aircraft where wood, steel tubing, and fabric construction limits the ground plane and electrical grounding integrity necessary for noise free operation of the *Stormscope* system. This caution applies to all steel tube/fabric construction aircraft such as the Bellanca Viking, Maule, Scout etc. Potential customers with these types of aircraft must be made aware of the strong possibility that even with extensive troubleshooting, it is likely that some degree of electrical interference cannot be removed. The sources of electrical noise vary so greatly, from one aircraft to another, that the Product Support Department can offer little or no assistance in isolating and eliminating noise problems on this type of aircraft.

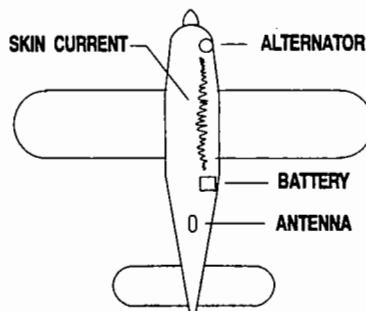
2.4.1 Interference Sources

Avoid mounting the antenna near active electrical components whenever possible. General clearance guidelines are:

- Strobe lamps and power supplies - 5 ft. (1.5 meters)
- Pitch trim servos and amplifiers - 3 ft. (1 meter)
- Fluorescent lamps and ballasts - 5 ft. (1.5 meters)
- Heater ignitors - 5 ft. (1.5 meters)
- Air conditioner and heater blowers - 5 ft. (1.5 meters)
- Pulse antennas - 4 ft., Minimum (1.2 meters)
- Flite phone antennas - 4 ft. (1.2 meters)
- VHF comm. antennas - 1 ft. (.3 meters)
- ADF antennas - 1 ft. (.3 meters)
- Any current-carrying cable (including the system display cable) - 2 ft. (0.6 meters)

2.4.2 Skin Current

Avoid mounting the antenna in the ground return current path between the battery and alternator, and the battery and blower motors or other heavy current carrying equipment. Aircraft skin currents may cause antenna interference.

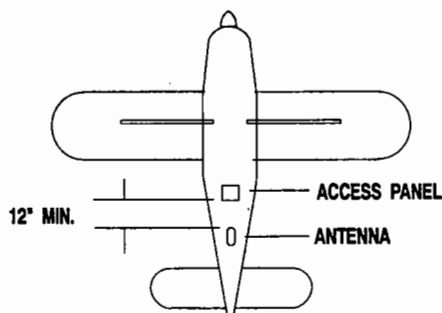


2.4.3 Skinmapping

In order to prevent potential interference problems, some of which are evident only during flight, a skinmap of the aircraft must be performed (with engines and all electrical systems operating) prior to every installation. This procedure will save installation time by avoiding the necessity for such things as antenna relocation or cable rerouting. At the very least, a WX-SM Skinmapper (BFG FlightSystems P/N 78-8060-5859-6) must be used to verify the suitability of a selected antenna location before proceeding with the installation. This must be done even if all the other placement criteria are met.

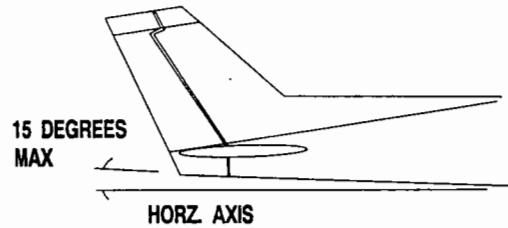
2.4.4 Ground Plane

The antenna must mount in a location with a minimum of 12 inches (30 cm) continuous aluminum ground plane in all directions. Avoid hinge lines, gear doors, and access panels by at least 12 inches (30 cm). Do not mount the antenna on an access panel.



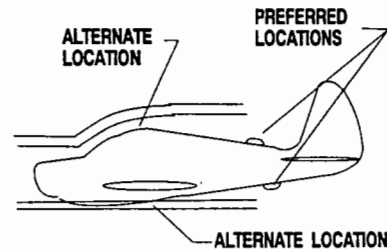
2.4.5 Alignment

The antenna need not be centered on the fuselage as long as its longitudinal axis is within 2 degrees of the aircraft longitudinal axis. The antenna should be mounted within 15 degrees of horizontal and may be mounted within 6 inches (15 cm) of a ventral fin. The antenna may mount on an upslope not to exceed 15 degrees of horizontal.



2.4.6 Slipstream

In general, the antenna should mount aft, where the slipstream boundary layer is thick, to reduce the effects of P-static. Exceptions to this are jet aircraft and where other installation criteria cannot be met. Top or bottom mounts provide equal performance.



2.4.7 Site Selection

Select an antenna location that satisfies the criteria outlined in the preceding paragraphs.

The ideal guidelines, of course, cannot always be met. If the installation criteria cannot be met, contact the BFG FlightSystems Product Support Department in Columbus, Ohio (U.S.A.), for location assistance.

(614) 825-2006
 FAX: (614) 825-2036

NOTE

Since BFG FlightSystems has no control over airframe integrity or aircraft configuration, the authorized installer is responsible for insuring a noise free installation. If additional labor is required to correct an interference problem caused by another aircraft system or component, BFG FlightSystems will not reimburse the installer for this labor under warranty. For this reason, the installer should anticipate such unexpected extra labor when quoting the installation to the customer, depending upon aircraft type and specific configuration.

2.5 ANTENNA DOUBLER INSTALLATION

Figure 2-4 indicates antenna mounting holes and dimensions.

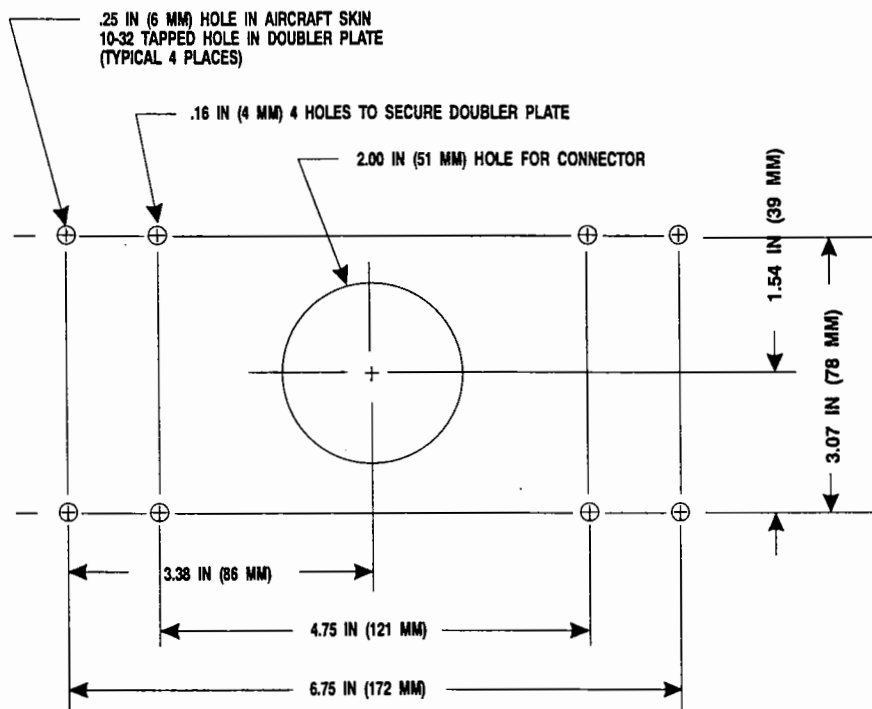


Figure 2-4. Antenna Mounting Holes

1. Use the antenna doubler plate as a template to mark hole locations on the aircraft skin.

NOTE

Ensure that the location selected allows adequate space inside the fuselage for the doubler plate to clear ribs and aircraft structure. (It may be necessary to cut the doubler plate to ensure proper fit.)

2. Mount the doubler plate to the inside of the fuselage as shown in Figure 2-5.

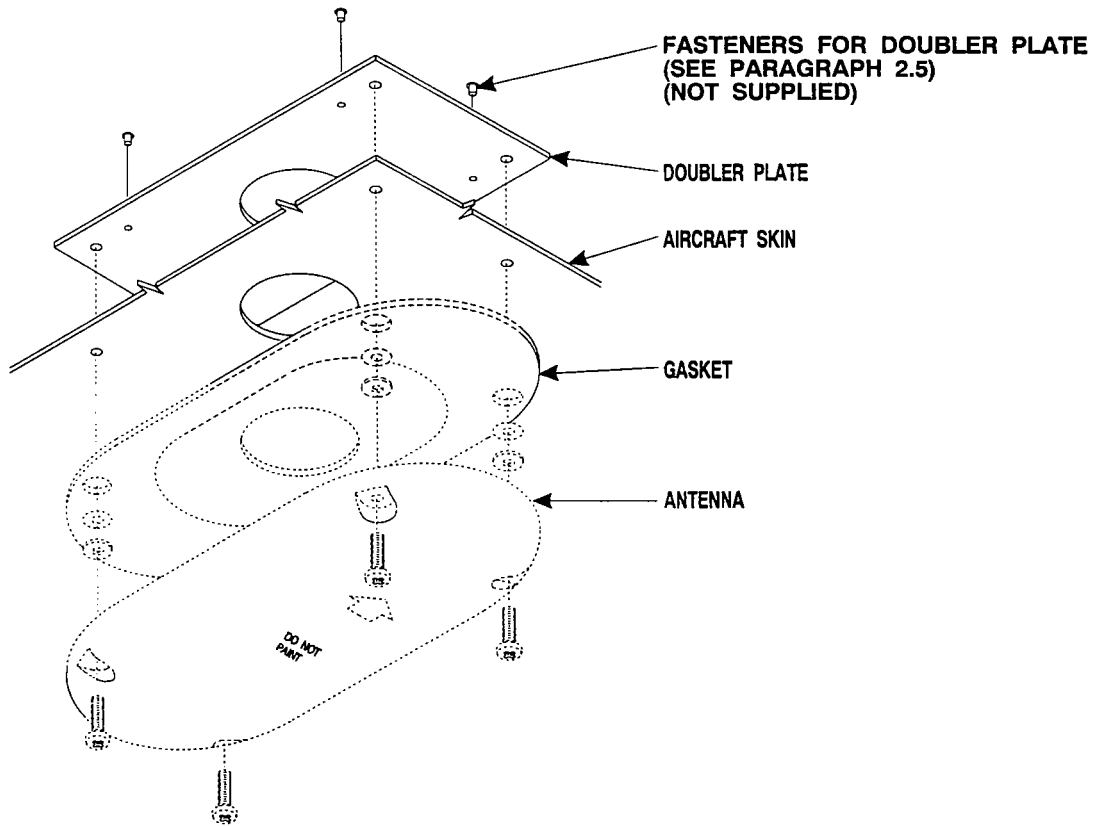


Figure 2-5. Antenna Doubler Installation

The doubler may be secured by using rivets or flush mount hardware (not provided).

The paint does not need to be removed from the aircraft skin beneath the doubler plate.

2.6 PROCESSOR LOCATION

2.6.1 Cable Length

All cable runs should be as short as practicable in order to minimize potential electrical interference. This is especially true for the antenna to processor cable run. (See 2.6.5 Antenna Proximity.)

2.6.2 Pressurized Aircraft

The processor may mount inside or outside the pressure vessel.

2.6.3 Orientation

Orientation of the processor is not critical. It may mount on its side, laterally, longitudinally, vertically, or inverted.

2.6.4 Cooling

No special cooling or ventilation is required for the processor.

2.6.5 Antenna Proximity

The processor should not be mounted closer than 1.5 feet (0.45 meters) to the antenna.

2.6.6 Site Selection

Select an appropriate location for the processor that satisfies the criteria outlined in the preceding paragraphs.

2.7 PROCESSOR TRAY INSTALLATION

2.7.1 Preparation

Drill the processor mounting panel holes as shown in Figure 2-6.

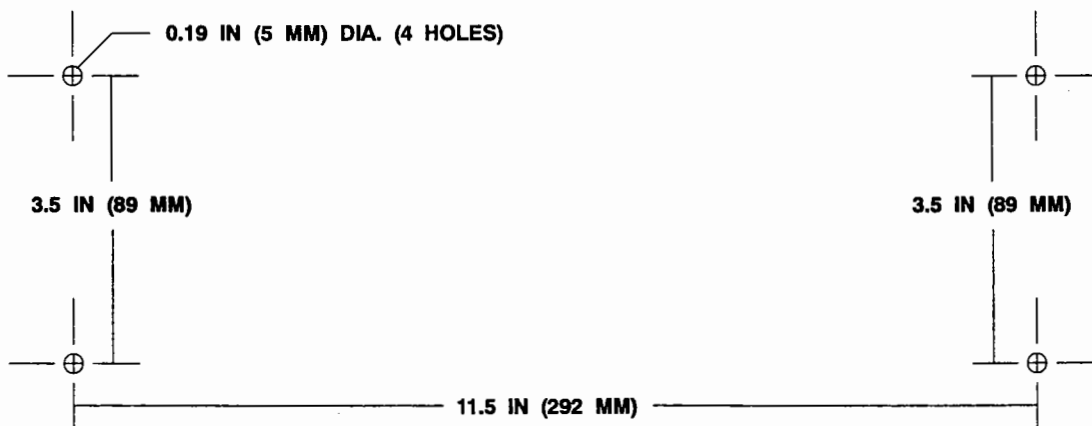


Figure 2-6. Processor Mounting Holes

2.7.2 Installation

Install the processor mounting tray as shown in Figure 2-7, using the four No. 10-32 x 1/2 screws and nut plates provided.

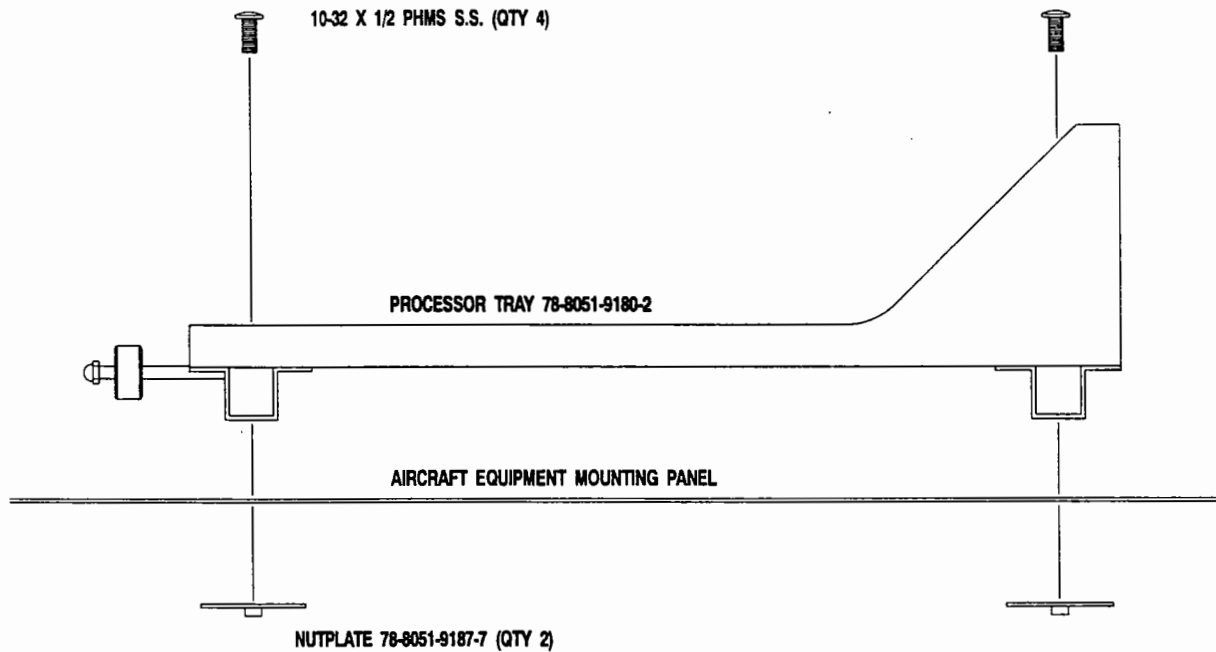


Figure 2-7. Processor Tray Installation

2.8 DISPLAY LOCATION

The *Stormscope* system display should be in a location easily accessible and visible to the pilot and/or co-pilot.

2.8.1 Magnetic Effect

Where possible to avoid it, the display should not be mounted within 3 inches (8 cm) of an electric turn and bank indicator, as the magnetic effect of the turn and bank motor may affect the display presentation. (a common symptom of magnetic interference is a wobbling or vibrating display raster.)

NOTE

If it is necessary to mount the display unit next to a device that may affect the CRT display, magnetic shielding material can be placed around the display unit. Shielding material is available from BFG FlightSystems. Specify P/N 78-8060-5882-8 when ordering.

2.8.2 Panel Depth

Adequate depth must be available behind the instrument panel to allow for the display, the display connector, and excess display cable. Remember, a service loop is necessary to allow access to the display connector when removing the display or inserting it into the instrument panel. (No display tray is necessary.)

2.8.3 Viewing Angle

The viewing angle for the CRT display is not a critical factor. The most favorable mounting position would be somewhat centered in front of the principal user and within arms reach.

2.8.4 Cooling

While the display has no special cooling requirements, it should be mounted to permit adequate ventilation.

2.8.5 Site Selection

Select an appropriate location for the *Stormscope* display module and prepare the panel cutout (see paragraph 2-9).

2.9 DISPLAY PANEL CUTOUT

The instrument panel cutout is a standard 3ATI as shown in Figure 2-8.

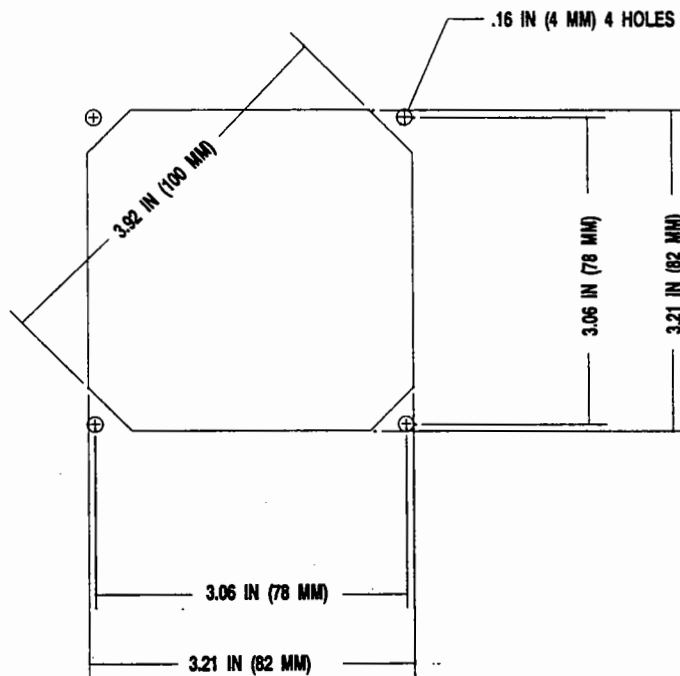


Figure 2-8. Display Panel Cutout and Mounting Holes

2.10 CABLE REQUIREMENTS

The *Stormscope* Series II system antenna, display, and synchro (WX-1000+ only) cables are critical in composition. To ensure proper system performance, all three cables require an overall shield consisting of foil and braid, covered with an insulating jacket.

The antenna, display and synchro cables must satisfy the requirements of:

MIL-W-22759
MIL-W-22759/18
MIL-C-27500
FAR 25.853, 25.1359(d) & Appendix F

In addition, all single wires of these cables meet MIL-W-22759 and MIL-W-22759/18, and the shielded & jacketed elements and completed cables meet MIL-C-27500. Colors of individual wires and jackets of sub-cables are in accordance with MIL-C-27500E (USAF) 3.2.1.1.2 Table IIA.

The cable required to connect the Navaid option of the WX-1000+ is much less critical. Any cable meeting MIL-C-27500 or MIL-C-168781/4 specifications (e.g. Belden #83319) is acceptable.

There is a table in section 2.10.5 of U.S. vendors who sell the required cables by the foot.

NOTE

Use of any cable not meeting BFG FlightSystems specifications voids all system warranties, and may be cause for termination of Authorized *Stormscope* Installer status.

2.10.1 Antenna Cable

The antenna cable consists of the following (refer to figure 2-9):

1. Twisted, shielded, jacketed triad #22 AWG
Colors: White, Blue, Orange
Shield: Tin plated copper braid, 90% min.
Jacket: FEP .007 in. min., White
2. Twisted, shielded, jacketed pair #24 AWG
Colors: White, Blue
Shield: Tin plated copper braid, 90% min.
Jacket: FEP .007 in. min., Blue
3. Same as 2 except Orange jacket.
4. Same as 2 except Green jacket.
5. Same as 2 except Red jacket.
6. Aluminized Mylar® wrap.
7. #34 AWG braided shield.
8. FEP Teflon® jacket .013 in. - .023 in., blue tint.
9. Marker tape with Vendor P/N.

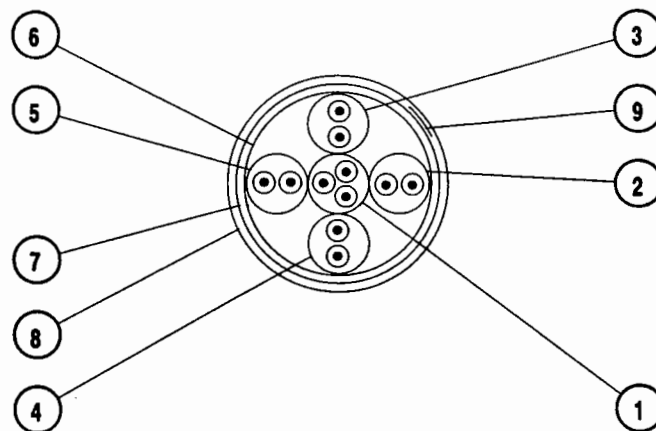


Figure 2.9. Antenna Cable Specification

2.10.2 Display Cable

The display cable consists of the following (refer to figure 2-10):

1. Twisted, shielded, jacketed triad #22 AWG
Colors: White, Blue, Orange
Shield: Tin plated copper braid, 90% min.
Jacket: FEP .007 in. min., White jacket
2. Twisted, shielded, jacketed pair #24 AWG
Colors: White, Blue
Shield: Tin plated copper braid, 90% min.
Jacket: FEP .007 in. min., Blue jacket
3. Same as 2 except Orange jacket.
4. Same as 2 except Green jacket.
5. Same as 2 except Red jacket.
6. Same as 2 except Black jacket.
7. Same as 2 except Yellow jacket.
8. Aluminized Mylar[®] wrap.
9. #34 AWG braided shield.
10. FEP Teflon[®] jacket .013 in. - .023 in., Red tint.
11. Marker tape with Vendor P/N.

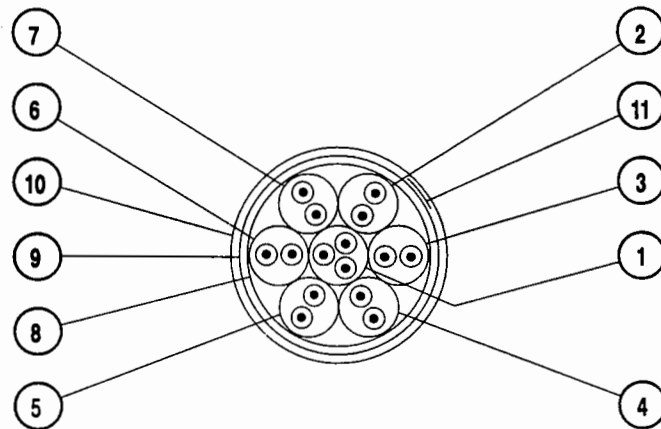


Figure 2-10. Display Cable Specification

2.10.3 Synchro Cable (WX-1000+ only)

The synchro cable consists of the following (refer to figure 2-11):

1. Twisted, Shielded, Jacketed Triad #24 AWG
Colors: White, Blue, Orange
Shield: Tin Plated Copper Braid, 90% min.
Jacket: FEP .007 in. min., White
2. Twisted, Shielded, Jacketed Pair #24 AWG
Colors: White, Blue
Shield: Tin Plated Copper Braid, 90% min.
Jacket: FEP .007 in. min., Blue
3. Same as Item 3, except Orange jacket.
4. Aluminized Mylar[®] Wrap.
5. #34 AWG braided shield.
6. FEP Teflon[®] jacket .013 in. - .023 in., clear (translucent).
7. Marker tape with Vendor P/N.

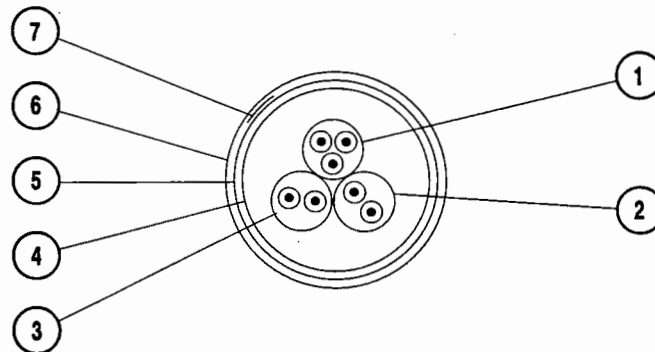


Figure 2-11. Synchro Cable Specification

2.10.4 Navaid Cable (WX-1000+ only)

The Navaid cable is a #22 AWG twisted, shielded cable that meets the requirements of:

- MIL-C-27500
- MIL-C-16878/4

2.10.5 Vendors

The table in figure 2-12 lists some U.S. vendors who sell the required cables by the foot.

Figure 2-12. Cable Vendors Table

US COMPANY	ANTENNA CABLE P/N	DISPLAY CABLE P/N	SYNCHRO CABLE P/N	NAVAID CABLE P/N
Dallas Avionics 1-800-527-2581 214-320-9776 FAX 214-320-1057	WX-4 (7.28 lbs/ 100 ft)	WX-3 (10.5 lbs/ 100 ft)	WX-5 (6.84 lbs/ 100 ft)	22TG3T14 (2 lbs/100 ft)
Electronic Cable Specialists 414-529-5500 FAX 414-529-5505	3N6711 (12.5 lbs/ 100 ft)	3N6715 (16 lbs/ 100 ft)	3N6607 (7.5 lbs/ 100 ft)	22TG3T14 (2 lbs/100 ft)
A.E. Petsche 817-461-9473 FAX 817-277-2887	TZANT (10.5 lbs/ 100 ft)	TZDIS (13.1 lbs/ 100 ft)	TZGYR (6.84 lbs/ 100 ft)	22TG3T14 (2 lbs/100 ft)
EDMO Distributors 1-800-235-3300 805-295-6689 FAX 1-800-828-0623 FAX 805-295-6703	WX-1000 ANTENNA	WX-1000 DISPLAY	WX-1000 SYNCHRO	22TG3T14
PIC Wire and Cable 1-800-742-3191 414-246-0500 FAX 414-246-0450	WM25811 (11.3 lbs/ 100 ft)	WM25815 (14.5 lbs/ 100 ft)	WM25807 (7.2 lbs/ 100 ft)	22TG3T14 (2 lbs/ 100 ft)
* 22TG2T14 may be used on RS-232 installations, but 22TG3T14 is preferred because it can accommodate both RS-232 and RS-422 instruments.				

NOTE

Use of any cable not meeting BFG FlightSystems specifications voids all system warranties, and may be cause for termination of Authorized Installer status.

2.11 CABLE ROUTING

2.11.1 Antenna Cable Routing

1. The antenna cable routing should be kept as short and direct as practical. (remember the Antenna Proximity caution in section 2.6.5.)
2. The antenna cable should not be bundled with any other aircraft cable, or with the WX-1000/WX-1000+ display cables, except for short distances, and then only when absolutely necessary.
3. If the antenna cable routes through a bulkhead connector, a dedicated connector must be used. (The antenna cable must not share a bulkhead connector with any other conductors, including the WX-1000/WX-1000+ display cable.)

2.11.2 Display Cable Routing

1. Routing and length of the display cable is not as critical as the antenna cable, but because of video frequencies in the cable, it should not bundle with or be routed near:

WX-1000/WX-1000+ antenna cable
VHF Comm antenna cables
ADF, Loran, or VLF antenna cables

2. The display cable must not run within 2 feet (0.6 meter) of the system antenna.

NOTE

A service loop should be provided in the display cable to allow the display connector to protrude through the panel cutout. This will allow for ease of installation and removal of the display, and will enable access to the connector for checking the cable.

2.11.3 Synchro Cable Routing (WX-1000+ only)

The synchro cable connects the WX-1000+ processor to a synchro bootstrap transmitter, or to the aircraft synchro heading system. This cable provides XYZ and HC aircraft heading information to the WX-1000+ processor. FLAG lines are also included in the synchro cable to provide the WX-1000+ processor with flag status (or heading valid) information.

Synchro cable routing and length is not critical to *Stormscope* system operation.

2.11.4 Power Cable Routing

The required *Stormscope* Series II system power conductors are #20 AWG wires which run from the processor to the aircraft circuit breaker panel. The positive battery wire connects to the circuit breaker. The negative battery wire connects to a ground near the battery.

Power cable routing and length is generally not critical to *Stormscope* system operation.

2.11.5 Navaid Cable Routing

1. Routing and length of the Navaid cable is not as critical as the antenna cable, but because of high frequencies in the cable, it should not bundle with or be routed near:

WX-1000+ antenna cable
VHF Comm antenna cables
ADF, Loran, or VLF antenna cables

2. The Navaid cable must not run within 2 feet (0.6 meter) of the system antenna.
3. The cable should not be any longer than necessary.

NOTE

Attenuation of signal strength occurs with excessive cable lengths. The maximum length for an RS-232C Navaid cable is 50 feet (18.3 meters). The maximum length for an RS-422 Navaid cable is not a factor in an aircraft environment.

2.11.6 ARINC-429 Cable Routing

1. Routing and length of the ARINC-429 cables is not as critical as the antenna cable, but because of high frequencies in the cables, they should not bundle with or be routed near:

WX-1000/WX-1000+ antenna cable
VHF Comm antenna cables
ADF, Loran, or VLF antenna cables

2. The ARINC-429 cables must not run within 2 feet (0.6 meter) of the system antenna, and the length should not be any longer than necessary.

NOTE

The maximum length of the ARINC-429 cable is not a limiting factor in an aircraft environment.

2.11.7 Inhibit Line

The *Stormscope* Series II system inhibit line is #22 AWG unshielded, and need be connected only if comm transmitters interfere with the WX-1000/WX-1000+ when in the weather mapping mode. This line can be included in the installation, but need be connected only if the testing of the final installation indicates transmitter interference.

Inhibit line routing and length is not critical to *Stormscope* system operation.

NOTE

The inhibit line is not needed if the *Stormscope* antenna and communications antennas are mounted on opposite sides of the fuselage.

2.12 CONNECTOR INSTALLATION

2.12.1 Connectors

Appropriate connectors are placed on the ends of the cables after they are installed. (All connectors provided with the system use size 20 screw-machined crimp-type contacts included in the hardware package.)

A. Antenna/Processor Cable

1. ITT CANNON 031-9074-002 sockets on antenna end (P201).
2. AMP 205090-1 sockets on processor end (P301).

B. Display/Processor Cable

1. AMP 205090-1 socket on display end.
2. AMP 205090-1 sockets on processor end (P301).

C. Navaid Cable

AMP 205090-1 sockets on processor end (P302).

D. ARINC-429 Cables

AMP 205090-1 sockets on processor end (P302).

CAUTION

It is important to use the proper crimping tool (listed in 2.12.2) for each of these contacts, and to follow the manufacturer's instructions for its use. Improper crimping of connector pins may result in degraded system performance or in system failure.

2.12.2 Wire Color Codes

Stormscope Series II system display, antenna, and synchro sub-cables are specified by BFG FlightSystems to be color coded to provide standardization between all WX-1000/WX-1000+ installations and to ease any necessary installation troubleshooting.

Observe specified color designations when terminating cables. (Colors are designated in Figure 2-19, System Interconnect.)

2.12.3 Shields

The gross (overall) shield may be removed several inches back from the connector to allow for improved flexibility. (See figure 2-13.) Ground overall shields to the airframe at the processor end only, using the shortest possible connection, with #18 AWG (or larger) wire.

The sub-cable color-coded jackets and shields should be left on the sub-cables as close to the connector as practical to provide the required shielding and to identify the sub-cables. (See Section 2.12.7.) Do not connect the sub-cable shields to the airframe.

2.12.4 Cable Termination

Install the appropriate connectors on the ends of the cables.

2.12.5 Cable Installation Checkout

After the wiring connections have been completed, the cables must be checked, pin to pin, to prevent possible damage to the system. Perform a continuity check of each wire in the cables.

Refer to the fold-out System Interconnect (figure 2-19) at the end of this section for the connector pin-outs.

2.12.6 Processor Connector Mounting

The plugs (P301, P302) that attach to the Processor tray must be mounted properly to engage the jacks on the back of the processor when it is installed in the tray.

1. Loosely attach P301 and P302 connectors to the processor tray, using the four 4-40 hex standoffs provided.
2. Slide the processor into the tray so that the connectors are engaged.
3. Tighten the Processor tray locking mechanism, ensuring that the processor rear panel screw heads contact the back plate of the tray.
4. Tighten the four 4-40 hex standoffs securing P301 and P302 connectors, thereby ensuring proper alignment of the processor connectors.
5. Remove the Processor from the tray.

2.12.7 Cable Preparation

Each cable terminating at the processor, display, or antenna should have the braided overall shield removed several inches back from the connectors so it will not cause a strain on the connector pins. See figure 2-13.

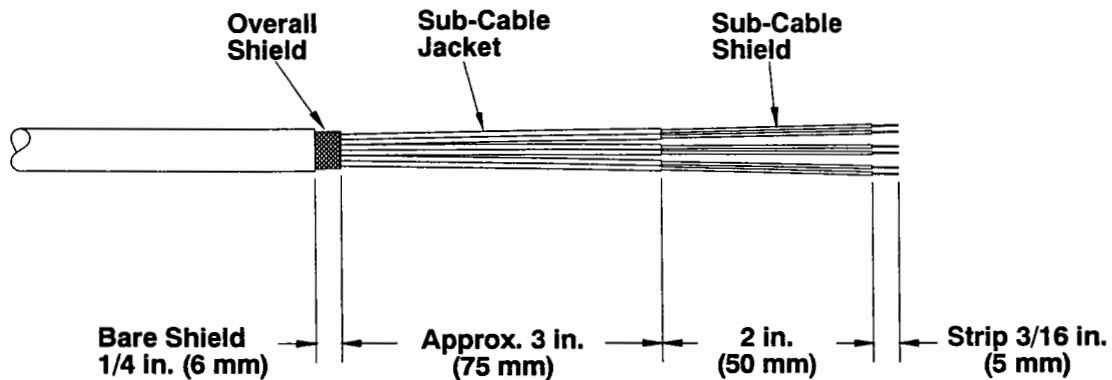


Figure 2-13. Cable Preparation

2.12.8 Strain Relief

Each cable terminating at the processor must be provided with a cable clamp on the jacketed area of the cable and secured to the processor tray or aircraft structure.

2.12.9 Synchro Connections (WX-1000+ Only)

The synchro cable connects the processor to the existing XYZ and HC signal or to a dedicated bootstrap. Refer to applicable manufacturer's publications for the heading system interface. (Examples are given in figure 2-14.) Connect the synchro signals to the processor, referring to the fold-out System Interconnect (figure 2-19) at the end of this section for connection detail.

Synchro Interface Selection Guide							
Heading System	P301						
	27(+)	28(-)	8(X)	41(Y)	25(Z)	11(H)	42(C)
Cessna ARC 200-9BC	N/A	N/A	A	E	D	C	B
Cessna ARC 40840-0204	N/A	N/A	N	M	L	B	L
Cessna Slaved DG	N/A	N/A	E	D	A	C	B
AIM Type 289-1-2	N/A	N/A	E	D	A	H	C
AIM Type 2892D	N/A	N/A	M	N	K	L	K
AIM Type 2892ED	N/A	N/A	M	N	K	L	K
Collins Type 331P-1V	N/A	N/A	N	M	D	B	L
Collins Type 331P-1	N/A	N/A	N	M	D	B	L
Century NSD360 DG & 722/755	N/A	N/A	1	2	3	7	5
Century NSD360A DG	36	1	1	2	3	7	5
Century Slaved DG	N/A	N/A	N	M	L	B	L
King KCS-55 w/KI-525A-01	N/A	N/A	P2-s	P2-v	P2-t	P2-r	P2-u
King KCS-55A w/KI-525A-01	P1-v	P2-P	P2-s	P2-v	P2-t	P2-r	P2-u
Sperry C6E, C6J	N/A	N/A	39	38	40	37	36
Sperry C6, C6A, C6C	N/A	N/A	18	19	20	21	41
Sperry C-14d	e	GND	a	b	Z	X	Y

NOTE

The WX-1000+ heading valid input is paralleled across the HSI flag coil, and the P302, 44-27 jumper is installed. This is true for both Flag Valid high and low outputs. (The connections shown for heading valid do not apply to software versions 1.21 and lower.) See General Information Section 1.4.4 C.

Figure 2-14. WX-1000+ Synchro Connections

2.12.10 Installation of Option Jumpers

Option Jumpers are installed on Processor Auxiliary Connector P302 to meet the following criteria:

OPTION	PINS TO BE JUMPERED
Top Mount Antenna	24 to 41
Cruise Speed (\geq 225 KIAS)	25 to 42
Synchro Connected	26 to 43
Flag Action (See figure 1-7.)	27 to 44

Figure 2-15. Option Jumper Selection Table

2.13 ANTENNA INSTALLATION

2.13.1 Curvature Compensation

The antenna and gasket are designed to mount to a flat, or large radius convex surface. For smaller radius contours, it may be necessary to hollow out the gasket to relieve stress in the center of the antenna (the area within the dashed line in figure 2-16). Spacers are provided to allow for compensation of the gasket thickness and for aircraft skin contour. (See Figure 2-16.)

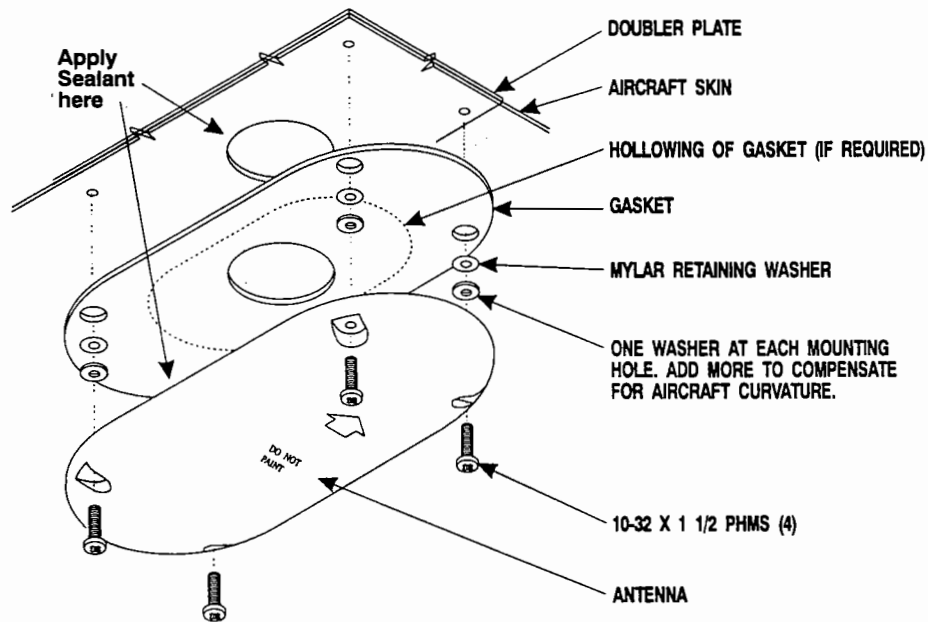


Figure 2-16. Antenna Installation

2.13.2 Antenna Mounting and Sealing

1. Mount the antenna to the aircraft as shown in Figure 2-16.
2. Seal around the connector opening and around the entire perimeter of the antenna.
 - a. For non-pressurized aircraft, use non-corrosive RTV (such as GE 2567-112, or equivalent).
 - b. For pressurized aircraft, use a sealant meeting MIL-S-8802.

NOTE

The antenna should not be sealed until the system performance tests are complete.

CAUTION

Do not over-tighten the antenna mounting screws during installation on convex surfaces. Doing so may cause stress cracks and shorten the life of the antenna.

2.14 PROCESSOR INSTALLATION

1. Ensure that the processor tray connectors engage properly. (See Section 2.12.6.)
2. Slide the processor into the tray to engage the connectors.

NOTE

Substantial hand pressure must be used when seating the processor into the rack. When properly seated, the processor front surface will be flush with the front edge of the tray, or slightly recessed (up to 1/16 inch). The processor rear panel screw heads should contact the back plate of the tray.

3. Tighten the hold-down mechanism.
4. Ground the processor by connecting a short, braided grounding strap from the P301 shell on the processor to the airframe. (Refer to figure 2-18, System Overview.)

2.15 DISPLAY INSTALLATION

Figure 2-17 shows a typical display installation. (The display can be mounted to the instrument panel from the front or from the rear.) An optional mooring clamp is available for increased stability in high-vibration environments.

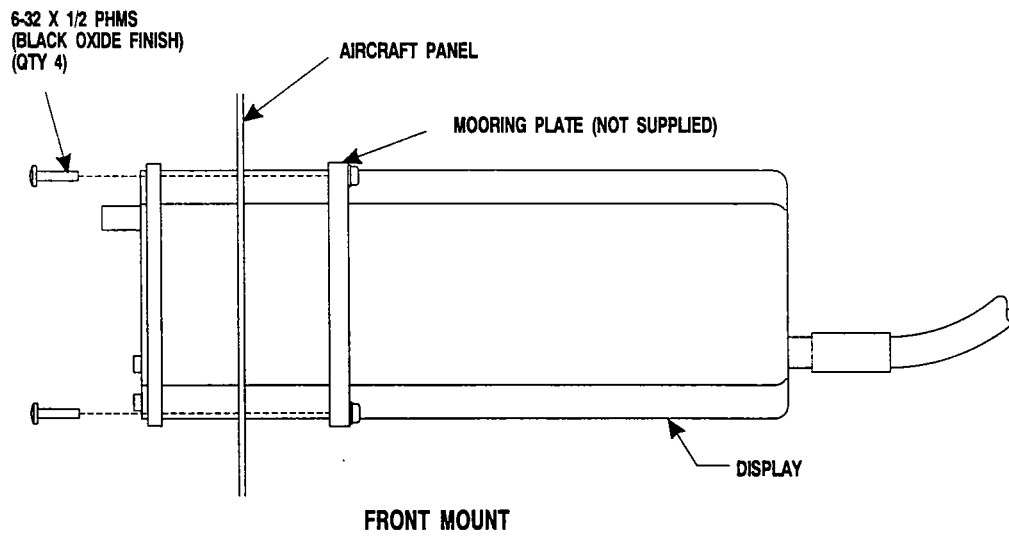
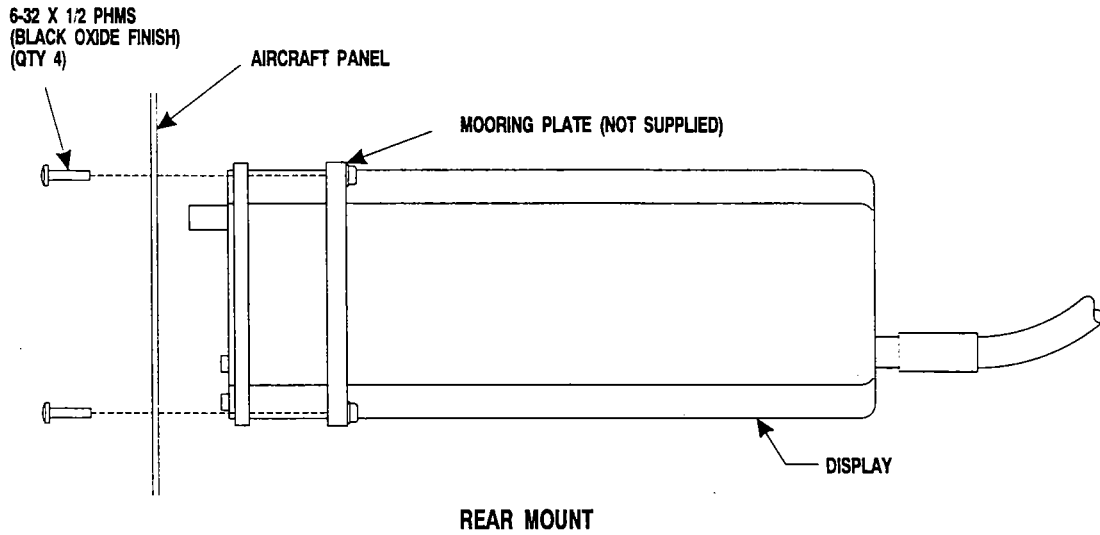


Figure 2-17. Display Installation

1. Use rivnuts[®] or a mooring clamp to secure the display to the instrument panel.
 - a. The mooring clamp is not furnished with the display.
 - b. A mooring clamp can be ordered when the *Stormscope* System order is placed.

BFG FlightSystems P/N 78-8060-5856-2

- c. A 3ATI mooring clamp is also available from:

MSP, Incorporated
R.R. 4, Box 383A
Nashville, Indiana 47448

(812) 988-6623 FAX (812) 988-6181

NOTE

It is the responsibility of BFG FlightSystems authorized dealers to install every *Stormscope* Series II system. The F.A.A. Major Airframe Alteration form (Form 337) must be filled out for each system installation. As with any avionics installation, you are subject to F.A.A. installation criteria. Failure to follow applicable regulations and complete the proper forms may void product warranties.

2.16 PERFORMANCE TEST

After the installation is completed, refer to Maintenance Section 5.7 to begin the performance test.

2.17 PAPERWORK REQUIREMENTS

At the completion of installation, the dealer must complete the three-part Warranty Registration Card. One copy is sent to BFG FlightSystems; one copy is given to the customer; and one copy is kept in the Dealer's customer file.

CHAPTER 3

OPERATION

3.1 INTRODUCTION

The primary purpose of *Stormscope* Series II systems is to alert the flight crew to the presence of thunderstorm activity. The object is to provide a means for the pilot to make thunderstorm avoidance decisions. The systems map electrical discharge activity 360 degrees around the aircraft to a distance of 200 nautical miles. The Model WX-1000+ has the capability of being connected to an external analog synchro heading source to maintain proper display orientation during turns.

In addition to the electrical discharge display, the systems also provide:

1. Electronic checklists which may be programmed in the field to meet the pilot's specific requirements.
2. An electronic clock which provides the current time and date, an elapsed time counter, and a stopwatch for timed approaches.
3. The WX-1000+ Navaid Option enables the simultaneous presentation of selected navigational data from a qualified Loran receiver on the *Stormscope* weather mapping display.

The following functions are performed by the processor continuously, regardless of the display mode selected.

1. Storm Data Acquisition

Electrical discharge data is acquired continuously on all ranges, even if the system is not in the weather mapping mode. This ensures that the data displayed to the operator is always current.

2. Continuous Self-Test

The system performs a continuous self-test during operation. Faults detected by the system are logged in non-volatile memory with a fault code and time tag. A message is displayed on the CRT indicating the error and any degradation of operating functions. The operator is prompted to press any button to resume operation. (Pressing the button confirms that the message has been seen.) Any failure of processor circuitry will be indicated on the processor's FAULT LED indicators (figure 3-3) as well as the CRT.

The following functions may or may not apply, depending on installation requirements which vary from one aircraft to another.

1. Inhibit

- a. The inhibit function is used to prevent system interference to electrical discharge data due to communications radio transmissions. Pressing the mic key inhibits electrical discharge data acquisition. If inhibited for longer than one minute, the *Stormscope* system will interrupt normal operation and display the error message "MIC KEY STUCK."

- b. Operation is resumed by pressing any key. The message will remain in every weather mapping display as long as the mic key remains stuck, however. The message will disappear upon release of the mic key.
- c. The inhibit function is only used when communication radio transmissions cause interference to electrical discharge data in a particular installation.

NOTE

If a "Mic Key Stuck" error is detected, verify that the aircraft radios are turned on, as some radios pull the mic key line to airframe potential when turned off, thereby inhibiting operation of the system.

2. Automatic Synchro Disable (WX-1000+ Only)

- a. If flag input is connected, the WX-1000+ will automatically disable heading stabilization and heading display in the event of a failure of the aircraft heading system. When this occurs, the message "FLAG" appears in place of the digital heading readout in the weather displays, and in place of the heading stabilization status in the Options mode. The WX-1000+ will resume full capability when the heading system resumes proper operation.
- b. This function is possible only with heading systems which provide a "compass valid" output signal.
- c. Manual disabling of the synchro function is provided for systems which do not provide "compass valid," or for when a heading system failure occurs which does not cause a compass valid error.

3.2 CONTROLS

All system operating controls are located on the panel mounted display. Figure 3-1 shows the location of controls on the display.

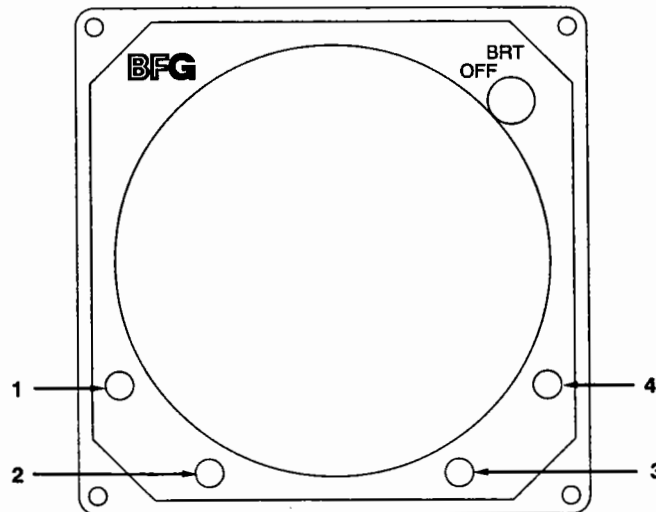


Figure 3-1. System Operating Controls

The system operating controls are as follows:

1. OFF/BRT

Rotating the OFF/BRT control clockwise turns the WX-1000/WX1000+ on and increases the brightness of the display.

2. Display Buttons (1 through 4)

A legend is generated on every non-fault display to identify the function of each of the four buttons in various modes of operation. (If a button is not labeled, it has no effect on the non-fault display shown.)

3.3 INDICATORS

The current status of the WX-1000/WX-1000+ may be determined by indicators on the display and on the processor.

3.3.1 Display

The panel mounted display generates all operator-usable information. General features of the display illustrated in figure 3-2 are:

1. Mode Legend

The Mode Legend appears in the top portion of normal non-weather displays to identify the selected mode of operation. In a weather mode, heading information appears in this location (WX-1000+ only).

2. Display Button Legend

A Display Button Legend appears on the display to identify the function of each button in each of the various non-fault modes. The functions of the buttons in each of the various mode displays are described in detail in Section 3.4, Operation.

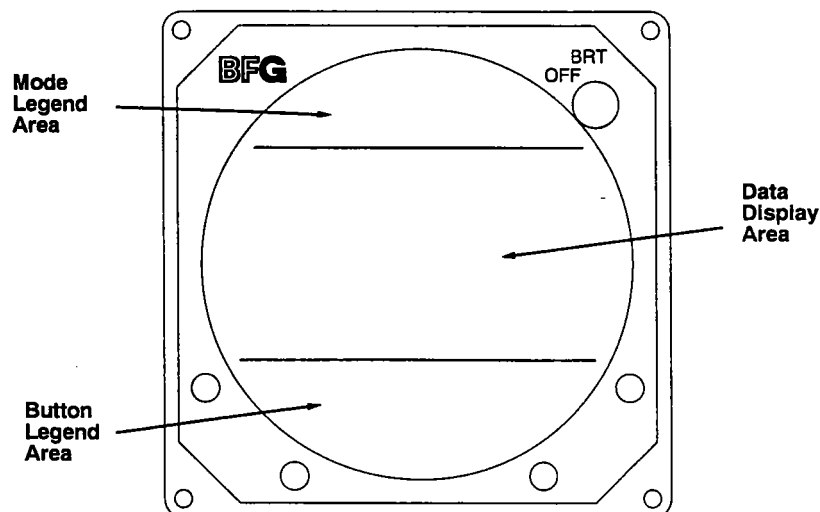


Figure 3-2. Information Display

3.3.2 Processor

The processor contains three externally visible status LEDs. See Figure 3-3.

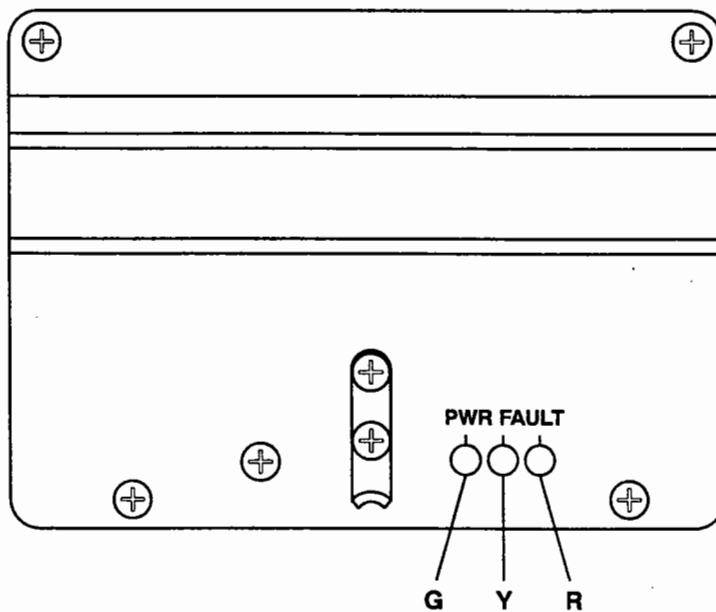


Figure 3-3. Processor Status LED's

The LEDs function as follows:

1. Green LED: power on indicator.
2. Yellow LED: fault indicator to indicate a failure detected by or in the processor power supply.
3. Red LED: fault indicator for faults detected by the system self-test. Once on, this LED will not turn off until power is recycled, even if the cause of the fault is removed.

3.4 OPERATION

3.4.1 Self-Test

Figure 3-4 shows the SELF-TEST presentation. A self-test is automatically initiated each time the system is turned on. Rotating the OFF/BRT control clockwise turns the system on and increases the display brightness.

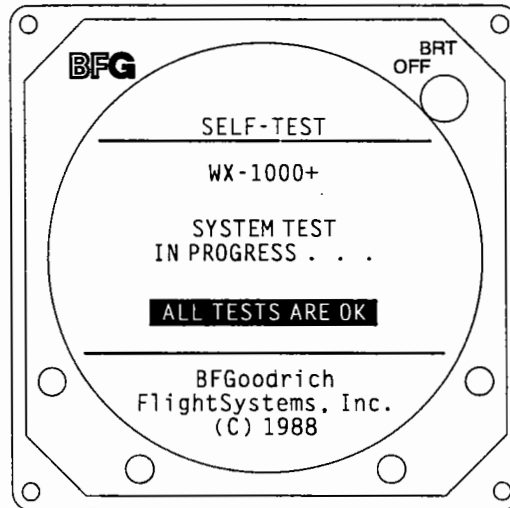


Figure 3-4. Self-Test Presentation

When the system is first turned on, the mode legend reads "SELF-TEST". During SELF-TEST the processor performs the following functions:

1. Executes a complete system self-test as described in the Systems Self-Test Table, figure 3-12.
2. Initializes video timing and electrical discharge processing.
3. Displays the confirmatory message "ALL TESTS ARE OK" upon satisfactory completion of all tests.
4. Automatically proceeds to the Main Menu.

NOTE

The system SELF-TEST at power-up takes approximately 15 seconds. If the system is turned on cold, it may complete the system self-test before the display filament warms up. In this case, the initial display seen will be the Main Menu.

3.4.2 Main Menu

Figure 3-5 shows the Main Menu. This display presents the operator with a menu of system operating modes.

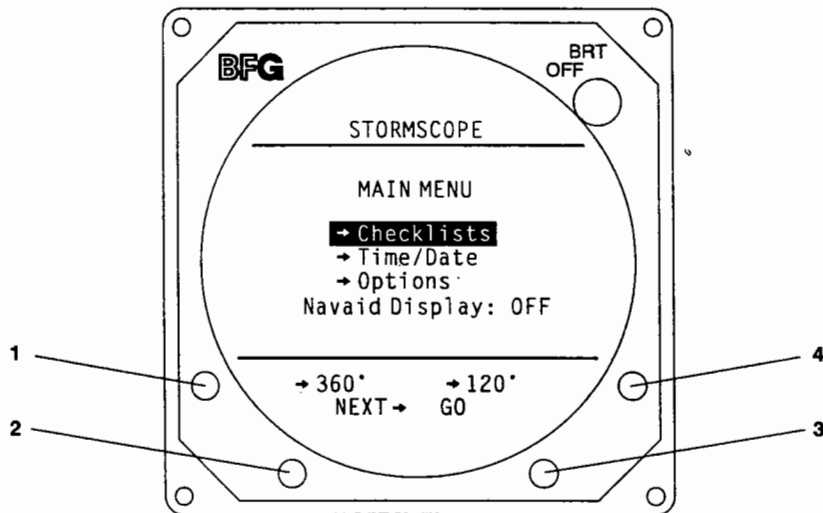


Figure 3-5. Main Menu Presentation

The Main Menu lists the following operating modes:

1. Checklists
2. Time/Date
3. Options
4. Navaid Display (if installed)

The buttons perform the following operations in this mode:

1. **360°** selects the 360 Degree Weather Mapping Mode (figure 3-5).
2. **NEXT** steps the highlight through the menu selections.
3. **GO** selects the mode indicated by the high-lighted menu selection.
4. **120°** selects the 120 Degree Weather Mapping Mode.

3.4.3 360 Degree Weather Mapping Mode

Figure 3-6 shows the 360 degree Weather Mapping Mode relative to the aircraft position in the center of the display.

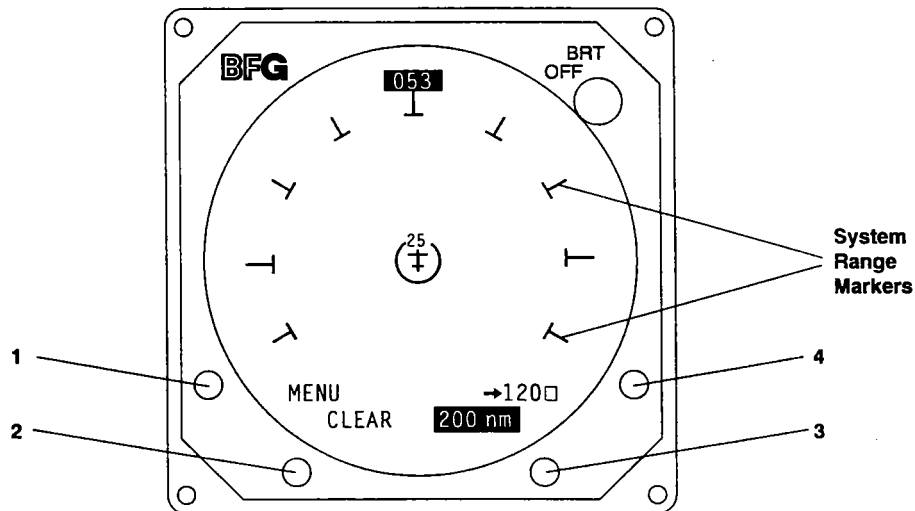


Figure 3-6. 360 Degree Presentation

The system displays 360 degree weather information on the CRT in this mode. The buttons perform the following operations (figure 3-6):

1. **MENU** switches the system back to the Main Menu (figure 3-5).
2. **CLEAR** erases the strike memory and clears electrical discharge information from the screen.
3. **XXXnm** steps down the *Stormscope* display ranges. (The ranges are 200, 100, 50, and 25 nm.)
4. **120°** selects the 120 Degree Weather Mapping Mode.

The system will display up to 512 of the most recent electrical discharges that fall within the selected range.

On the Model WX-1000+, electrical discharge data is heading stabilized in this mode. (The aircraft heading will be digitally displayed at the top of the CRT.)

3.4.4 120 Degree Weather Mapping Mode.

Figure 3-7 shows the 120 degree, enlarged, forward only, Weather Mapping Mode. In this presentation bearing lines are displayed at the coverage limits and also at 30 degrees on either side of the aircraft heading.

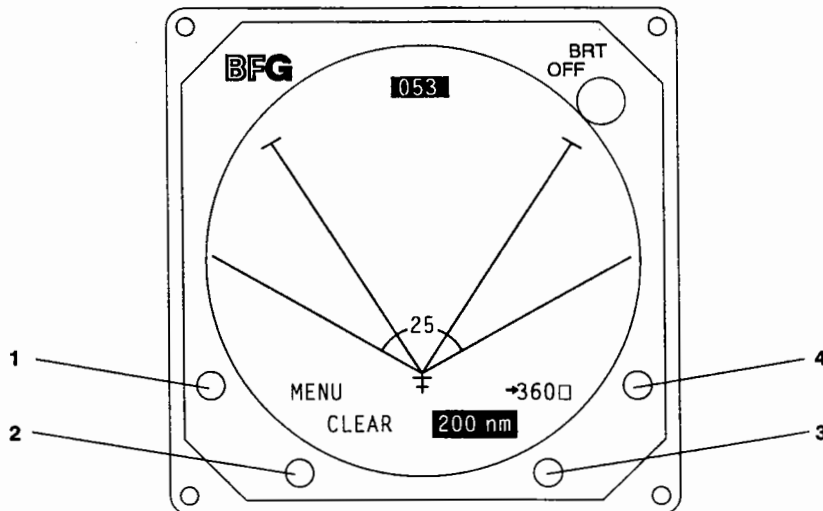


Figure 3-7. 120 Degree Presentation

The system displays the 120 degree, forward sector weather information on the CRT in this mode. The buttons perform the following operations (figure 3-7):

1. **MENU** switches the system back to the Main Menu (figure 3-5).
2. **CLEAR** erases the strike memory and clears electrical discharge information from the screen.
3. **XXX nm** steps down the *Stormscope* display ranges. (The ranges are 200, 100, 50, and 25 nm.)
4. **360°** selects the 360 Degree Weather Mapping Mode.

The system displays the 256 most recent electrical discharges which fall within the selected range and the 120 degree sector being viewed.

On the WX-1000+, electrical discharge data is heading stabilized in this mode. (The aircraft heading will be digitally displayed at the top of the CRT.)

3.4.5 Checklist Mode

Figure 3-8 shows the Checklist Mode.

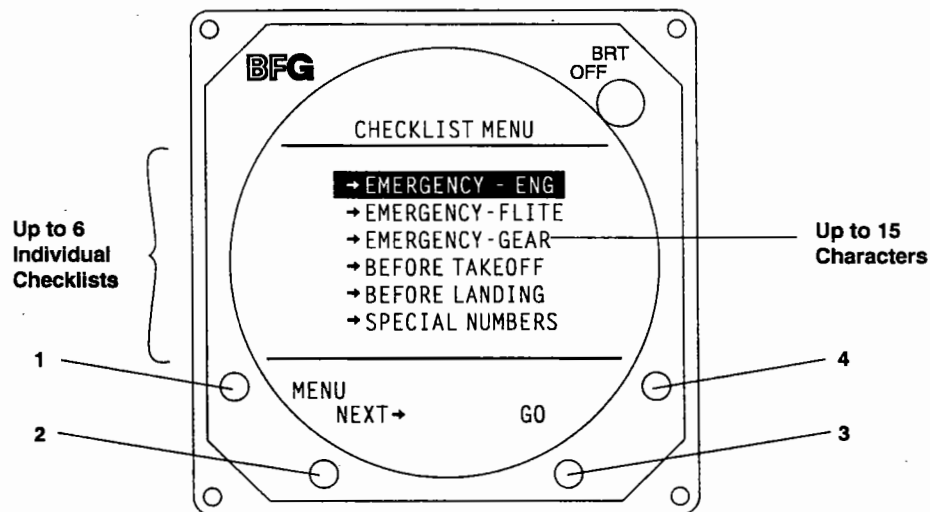


Figure 3-8. Checklist Mode Presentation

Pressing the **GO** button with the checklist mode high-lighted on the Main Menu (figure 3-5) will cause the Checklist Menu to be displayed.

The Checklist Menu display presents the operator with the titles of the checklists that were previously entered using the WX-PA portable analyzer.

The buttons perform the following operations in this mode (figure 3-8):

1. **MENU** switches back to the Main Menu.
2. **NEXT** steps the highlight bar through the checklists.
3. **GO** selects the checklist indicated by the high-lighted selection.
4. (No function.)

The system stores up to six individual checklists with a maximum of 30 items per checklist. Each checklist title has a maximum of 15 characters. Each checklist item has a maximum of 20 characters.

Pressing the **GO** button will cause the high-lighted checklist to appear in the display.

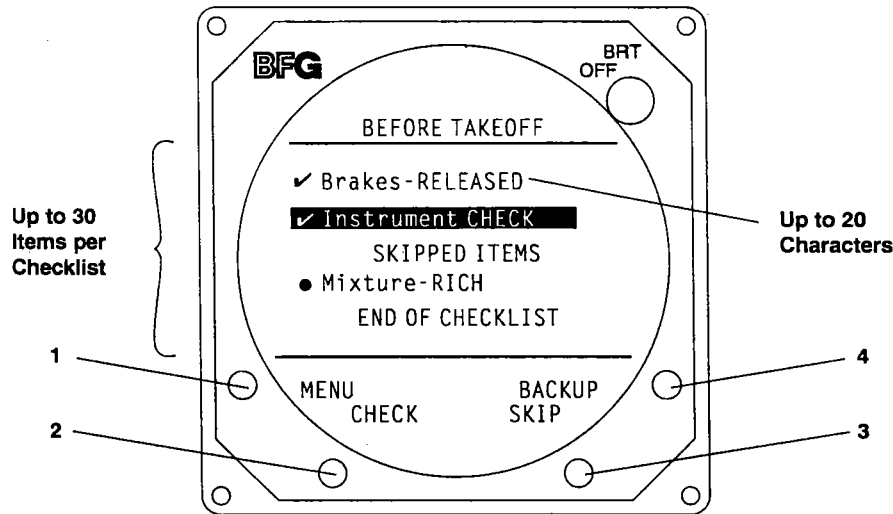


Figure 3-9. Checklist Item Presentation

The display presents the operator with the list of items in the selected checklist. The buttons perform the following operations in this mode (figure 3-9):

1. **MENU** switches back to the Main Menu (figure 3-5).
2. **CHECK** checks off the high-lighted item and scrolls the next item into the highlight.
3. **SKIP** skips the current item in the highlight, stores it for recall, and scrolls the next item into the highlight.
4. **BACKUP** scrolls the list downward so that the previous item is high-lighted.

Skipped items will reappear at the end of the list after all other items have been checked off. Skipped items are indicated by a large dot (Mixture - RICH in figure 3-9). Checked items are indicated by a check mark. A small dot indicates an item that has not been checked or skipped. The message "checklist complete" will only appear after all items have been checked off, including those initially skipped.

3.4.6 TIME/DATE Mode

Figure 3-10 shows the Time/Date Mode.

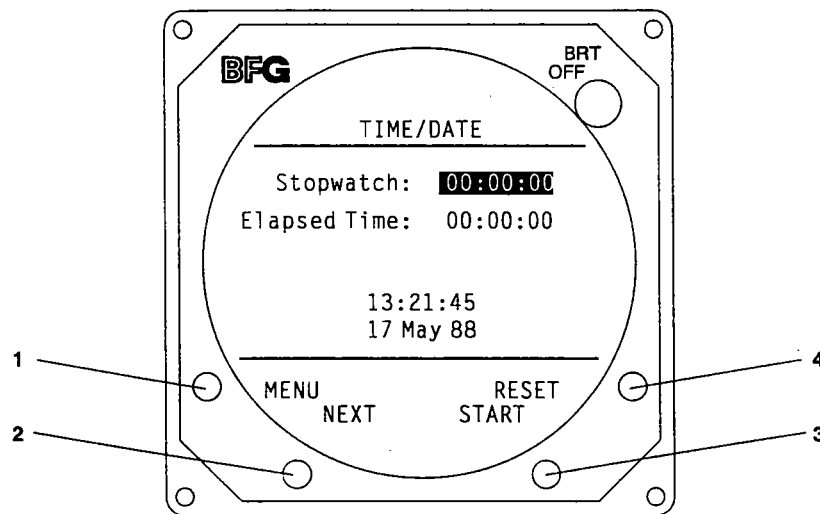


Figure 3-10. Time/Date Presentation

Pressing **GO** with the Time/Date mode high-lighted on the Main Menu (figure 3-5) will cause the **TIME/DATE** mode to be displayed. The **TIME/DATE** mode displays the stopwatch, elapsed time counter, and current time and date. The buttons perform the following functions in this mode (figure 3-10):

1. **MENU** switches back to the Main Menu.
2. **NEXT** steps the highlight bar through the stopwatch, elapsed time counter, and each portion of the **TIME/DATE** display.
3. Function varies depending on high-lighted item. (Function is indicated.)
4. Function varies depending on high-lighted item. (Function is indicated.)

A. Stopwatch Display

The stopwatch is a zero-based, upcounting timer which counts hours, minutes and seconds up to 99:59:59. The stopwatch is selected by placing the highlight bar over the stopwatch time using the **NEXT** button. Display buttons 3 and 4 have the following functions (figure 3-10):

- 3 **START** when the stop watch is not running.
STOP when the stopwatch is running.
- 4 **RESET** returns the stopwatch to 00:00:00.

The stopwatch is automatically reset to 00:00:00 on power-up.

B. Elapsed Timer

The elapsed timer is a zero-based, upcounting timer which counts hours, minutes and seconds up to 99:59:59. The elapsed time is selected by placing the highlight bar over the elapsed time, using the **NEXT** button. Display Buttons 3 and 4 have the following functions (figure 3-10):

- 3 START when the timer is not running.
 STOP when the timer is running.
- 4 RESET returns the timer to 00:00:00.

The elapsed timer will retain its count in the absence of power. (Removing power will have the same effect as pressing **STOP**.)

C. TIME/DATE

The TIME/DATE display is an automatically incrementing clock. The TIME/DATE is set by stepping the highlight through the hours, minutes, seconds, date, month and year using the **NEXT** button. Display Buttons 3 and 4 have the following functions (figure 3-10):

- 3 DOWN decreases the high-lighted numeral.
- 4 UP increases the high-lighted numeral.

The time and date remains current in the absence of power.

3.4.7 Options Mode

Pressing **GO** with the Options mode high-lighted on the Main Menu will cause the **OPTIONS** mode to be displayed. The **OPTIONS** mode displays the results of the continuous self-test and allows the operator to initiate a complete self-test. Figure 3-11 shows the Options Mode.

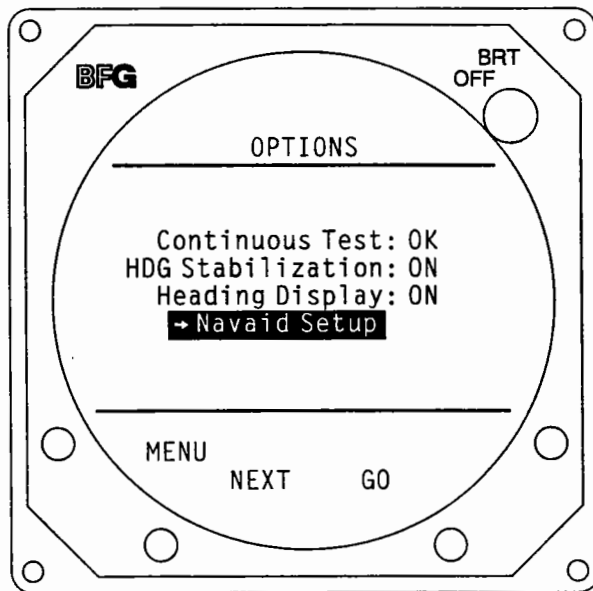


Figure 3-11. Options Presentation

In the WX-1000+, the Options mode also allows manual disabling of the heading stabilization and heading display if a compass failure should occur without causing a flag condition. When operating with heading stabilization, the operator may elect to have the heading display "ON" or "OFF" when in any weather mode. The buttons perform the following functions (figure 3-11):

1. **MENU** switches back to the Main Menu (figure 3-5).
2. **NEXT** steps the highlight through the Continuous Test, Heading Stabilization, Heading Display, and Navaid Setup (if Navaid installed).
3. Function varies depending on high-lighted item. (Function is indicated.)
4. (No function.)

The system displays the results of the continuous self-test in this mode. If no faults have been detected, the message "OK" is displayed. If a fault has been detected, The message "FAULT" is displayed.

When the highlight is placed over continuous test, Button 3 is labeled **TEST**. Pressing this button causes the system to conduct an operator-initiated self-test. If any errors are detected, a message indicating the affected functions is displayed. Refer to Maintenance Section 5.8.2 for a list of various errors and their associated messages.

The table in figure 3-12 summarizes the items that are included in the start up self-test, the continuous self-test, and the operator-initiated self-test. The table also lists the features of the *Stormscope* system that will not function if a tested item fails.

When the highlight is placed over HDG Stabilization, Button 3 is labeled **ON/OFF** (WX-1000+ only). Pressing this button turns the heading stabilization "ON" or "OFF", as indicated in the highlight.

When the highlight is placed over Heading Display, Button 3 is labeled **ON/OFF** (WX-1000+ only). Pressing this button turns the heading display "ON" or "OFF", as indicated in the highlight.

SELF-TEST ITEMS					
TEST ITEM	START UP	OPERATOR-INITIATED	CONTINUOUS	AUTO RECOVERY	FAILURE PRECLUDES:
Antenna	X	*	F	Y	Storm Display
Analog Processing	X	X	C	Y&	Storm Display
Video Output	X	X		N	System Operation
Data Memory	X	X		N	System Operation
Video Memory	X	X		N	System Operation
Program Memory	X	X	C	N	System Operation
Software Model & Ver. Check	X			N	System Operation
Non-Volatile Memory	X	X		N	1. Checklist Operation 2. Fault Log Operation
Heading Valid Flag		*	F	Y	1. Heading Stabilization 2. Heading Display
Gyro Processing	X	X		N	1. Heading Stabilization 2. Heading Display
WX-PA Communications	X	X&		Y	Communication With Test Equipment
Inhibit Stuck		*	F	Y	Strike Processing
Clock Battery	X	X	C	N	Time/Date Display
Serial Port A	E	E		N	Navaid Option Operation
Serial Port B	E	E		N	Serial Port B Functions

X = Test performed.

C = Test performed every 15 seconds.

F = Test performed every 1 second.

* = Result of last test (by continuous self-test) is used as a result.

& = Version 2.00 or higher software only.

E = Test performed when an Expansion Interface board option is installed.

Figure 3-12. System Self-Tests Table

3.4.8 Navaid Setup Mode

Figure 3-13 shows the Navaid Setup display.

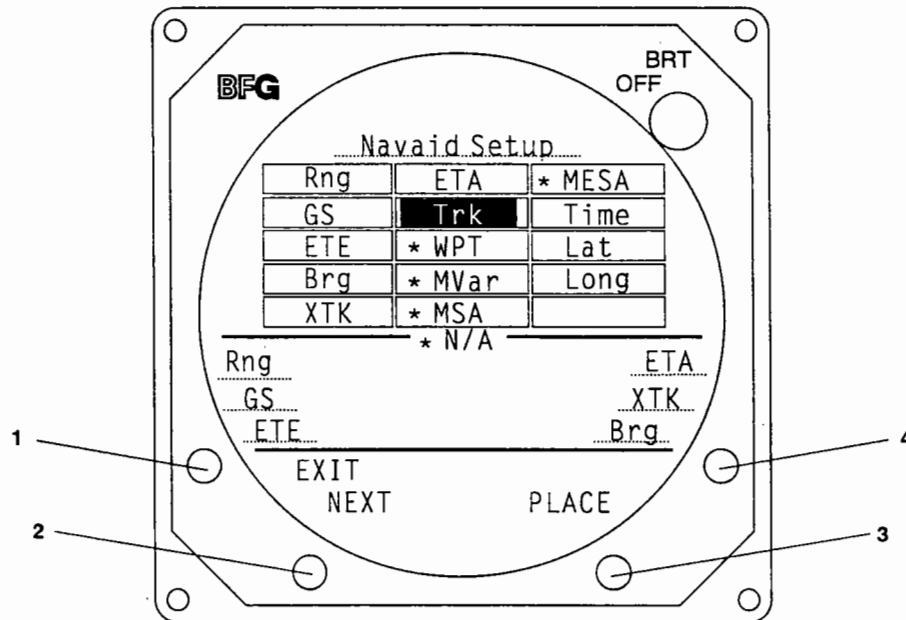


Figure 3-13. Navaid Setup Presentation

This item will be on the Options menu only if the Navaid Option is installed. Pressing GO with Navaid Setup highlighted will cause the Navaid Setup mode to be displayed. The mode enables an operator to select up to six items of navigational data to be shown on all *Stormscope* weather mapping displays. The first six items shown in the display grid are default items. When a *Stormscope* system with a newly installed Navaid Option is powered up for the first time, these items will be displayed on all weather screens. The item display can be switched off, or individual items can be changed or replaced with a blank. The buttons perform the following functions (figure 3-13):

1. **EXIT** returns the display to the Options menu (figure 3-11).
2. **NEXT** advances the highlight bar to the next navigational item in the grid.
3. **PLACE** duplicates the high-lighted item in the grid on the first of the six display lines for navigational data. The highlight disappears from the grid. (The item from the grid appears on the first line even if another item is already there.) See figure 3-14.
4. (No function.)

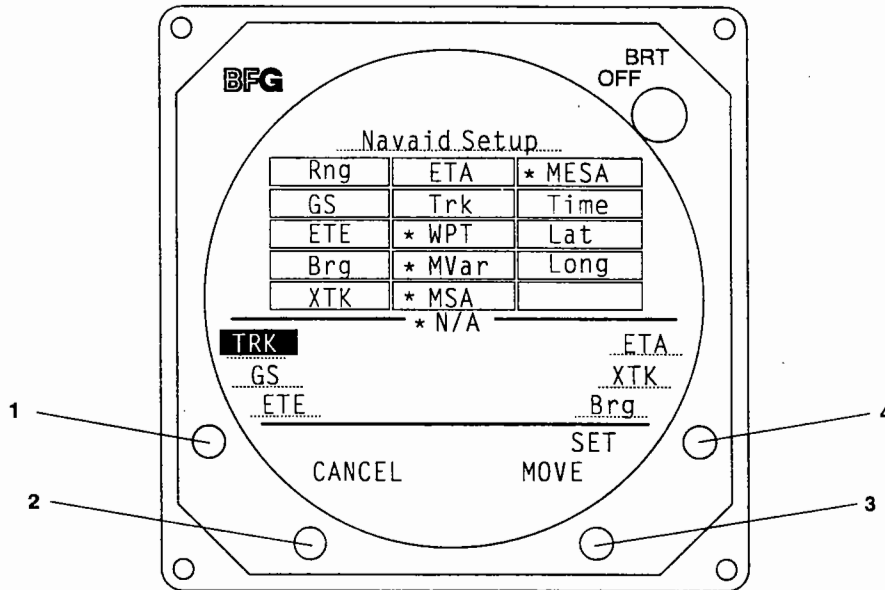


Figure 3-14. Selected Item "Placed"

When a high-lighted navigational item from the grid is PLACED with the items that will be displayed, the button legend changes (figure 3-14). The buttons now perform the following functions:

1. (No function.)
2. CANCEL returns the highlight to the grid item where it started and removes the item that was PLACED. (The button legend also changes back.)
3. MOVE advances the high-lighted item to the next line.
4. SET inserts the item on the line it currently occupies, replacing any previous item, and removing the highlight. (The highlight reappears in the grid on the next item available for PLACING.)

NOTE

Not all the navigational items in the grid are available from every Loran/GPS. If an item cannot be obtained from the Loran/GPS on the aircraft, it will be indicated by an asterisk, meaning that it is not available, or "N/A." The highlight will skip items marked with an asterisk.

NOTE

When a blank has been SET on one of the display lines, the highlight will return to the blank in the grid.

There are 14 items and one blank that can be selected from the item grid. An item PLACED from the grid is superimposed over any item already on a line. If SET is pressed, the item originally on the line is replaced by the item that was moved down. The blank in the list allows an item to be removed from a line without replacing it with another item. (It is replaced with the blank.)

The navigational items on the six lines will be displayed in the same relative position on all weather mapping displays (if the function is on). Pressing **EXIT** (figure 3-13) will return the display to the Options menu (figure 3-11). Pressing **MENU** in this display will bring back the Main Menu (figure 3-15). Once an item is set, it will be displayed in the set position each time the system is powered up, unless a new item is set in that position.

3.4.9 Navaid Display

The Navaid Display "ON" or "OFF" selection will appear on the Main Menu only if the Navaid option is installed. When the highlight is advanced to the Navaid Display line of the Main Menu, only the ON/OFF indicator is high-lighted.

1. The legend for button 3 changes to **ON/OFF**.
2. Pressing button 3 will change the indicated Navaid Display status.

The ON/OFF status refers to the display of the navigational items selected in the Navaid Setup Mode of the Options menu. Figure 3-15 shows the Main Menu with Navaid Display selected. (Only the "ON" is high-lighted.)

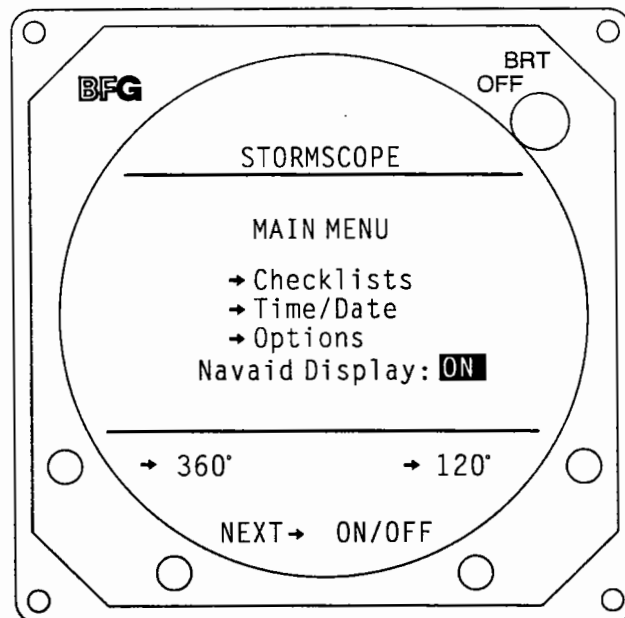


Figure 3-15. Navaid Display Status

Figure 3-16 shows the 360 degree weather screen with the selected navigational data displayed. The course line, waypoint, and course deviation indicator (CDI) are also shown.

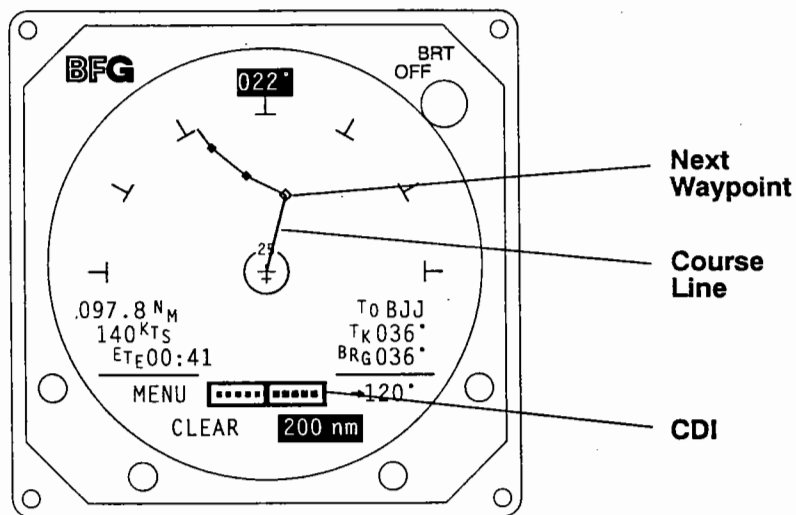


Figure 3-16. Navaid Option Data Display

The Course Deviation Indicator (CDI) representation at the bottom of the screen and the course line to the next programmed waypoint are normally present when the Navaid Option is installed.

A nav flag is displayed when Loran information to the Navaid is missing. The Loran nav flag indicates that the Loran has failed, or that the signal from the selected Loran station is no longer being received. The CDI information is replaced by a "NAV FLAG" message and any displayed navigational items disappear. See Figure 3-17 for an example.

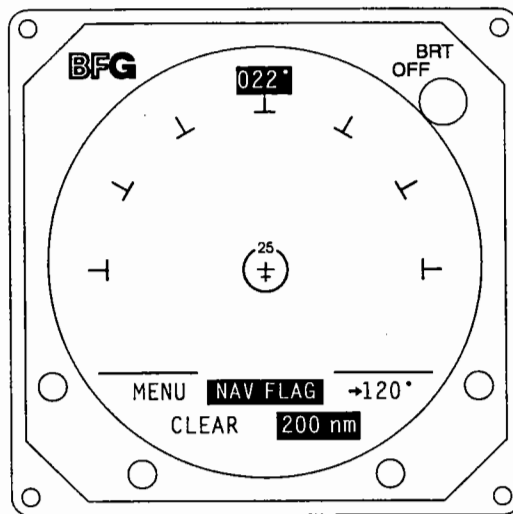


Figure 3-17. LORAN Nav Flag Display

A highlighted "w" appears beside affected navigational items displayed on the screen when the Loran receiver's self-monitoring circuits indicate that position certainty is not within 1.7 nautical miles. (The "w" appears below the CDI indicator.) See figure 3-18 for an example.

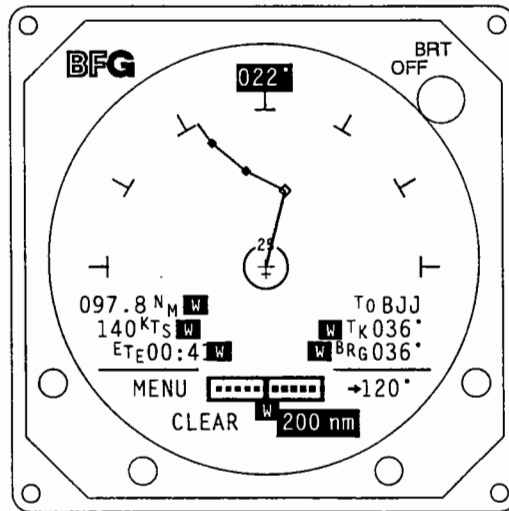


Figure 3-18. Loran Warning Display

3.4.10 Special Power-Up Modes (Software Version 1.21 and Lower)

These special functions are provided for the installer/troubleshooter. *Stormscope* systems with software version 1.21 or lower do not have as many service-related features as those with 2.00 software or higher. The systems with 1.21 or lower software can access a display that indicates the exact software version and installation jumper status, and a display that enables the self-test function to be disabled. *Stormscope* systems with software version 2.00 or higher have these same capabilities as part of a more extensive Service Menu.

A. Software Version and Installation Status

1. This special mode is accessed by holding Button 3 depressed as the system is turned on. The processor software version number is indicated on the back (connector end) of the processor. This mode displays the following information:
 - a. System model (WX-1000, WX-1000+, or WX-1000E).
 - b. Software version number.
 - c. Antenna mounting (top or bottom), as read from the option jumper.
 - d. Cruise Speed, as read from the option jumper.
 - e. Gyro connected status, as read from the option jumper.
2. The system resumes normal operation when any button is pressed.

B. Self-Test Disable

1. This special mode is accessed by holding display Button 4 depressed as the system is turned on. This allows disabling all system self-tests. This mode should be used when the system is connected to test equipment (WX-PA) which replaces the antenna. Otherwise, extraneous error messages may appear since the system antenna is not connected.
2. After the "SELF TEST DISABLED" message is displayed, the system continues operation without self-tests when any button is pressed.

CAUTION

The self-test disable mode should be used when troubleshooting problems in the aircraft (refer to "Troubleshooting" in Maintenance Section 5). It must never be used during normal in-flight operation, however, because the diagnostics that warn of improper system operation are not active.

3.5 SERVICE MENU (SOFTWARE VERSION 2.00 AND HIGHER)

The Service Menu display and the expanded number of service-related capabilities it provides is available only in *Stormscope* systems with version 2.00 or higher software installed in the processor. (Refer to section 3.4.10 for similar data available from systems with version 1.21 or lower processor software.)

The Service Menu is intended as an aid in installing, testing and troubleshooting WX-1000/1000+ systems. The Service Menu items are to be used only for testing and troubleshooting an installation, and must not be used in normal system operation. While in the Service Menu, the WX-1000/1000+ internal self-test is not operational; therefore, any system errors will not be detected or displayed.

The Service Menu is accessed by holding buttons 1 and 2 (the left two buttons) depressed as the system is turned on. (The processor software version is indicated on the back end of the processor.) The Service Menu is shown in figure 3-19.

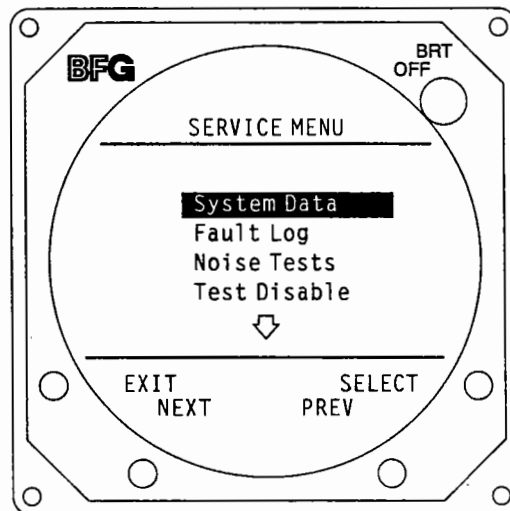


Figure 3-19. Service Menu Presentation

The buttons perform the following operations in this mode:

1. **EXIT** switches back to the Main Menu (figure 3-5).
2. **NEXT** steps the highlight bar to the next item on the list.
3. **PREV** steps the highlight bar back to the previously high-lighted item.
4. **SELECT** activates the display indicated by the highlight bar.

The Service Menu provides the following choices:

1. System Data
2. Fault Log
3. Noise Tests
4. Test Disable
5. Expansion Data (Expansion Interface PCB installed)
6. Expansion Tests (Expansion Interface PCB installed)
7. LORAN Setup (Navaid Expansion Interface PCB installed)
8. LORAN Raw Data (Navaid Expansion Interface PCB installed)

Items 1. through 4. are always displayed when the Service Menu is entered. Items 5. through 8. are accessed by pressing the **NEXT** button to scroll the highlight down to reveal each item. The individual items are explained in the following sections.

3.5.1 System Data Mode

Pressing **SELECT** with System Data high-lighted on the Service Menu causes the **SYSTEM DATA** display to appear. An example of the **SYSTEM DATA** display is shown in figure 3-20.

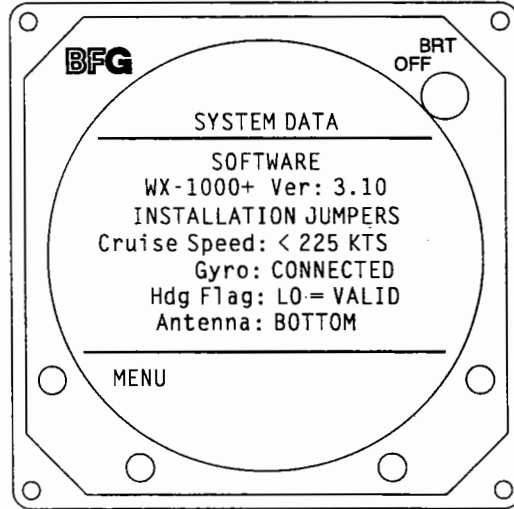


Figure 3-20. System Data Presentation

Button 1 (**MENU**) is the only one that is functional. It switches the display back to the Service Menu.

Software Version and Installation Status mode displays the following information:

1. System model (WX-1000, WX-1000+, or WX-1000E)
2. Software version number
3. Installation jumpers indicating:
 - a. Speed (>225KTS or <225 KTS)
 - b. Gyro status (connected or disconnected)
 - c. Heading Flag Status (HIGH-VALID or LOW-VALID)
 - d. Antenna location (TOP or BOTTOM)

Pressing **MENU** returns the Service Menu display.

3.5.2 Fault Log Mode

Pressing **SELECT** with Fault Log high-lighted on the Service Menu causes the PAGE 1 screen of the Fault Log to appear. The PAGE 1 display is shown in figure 3-21.

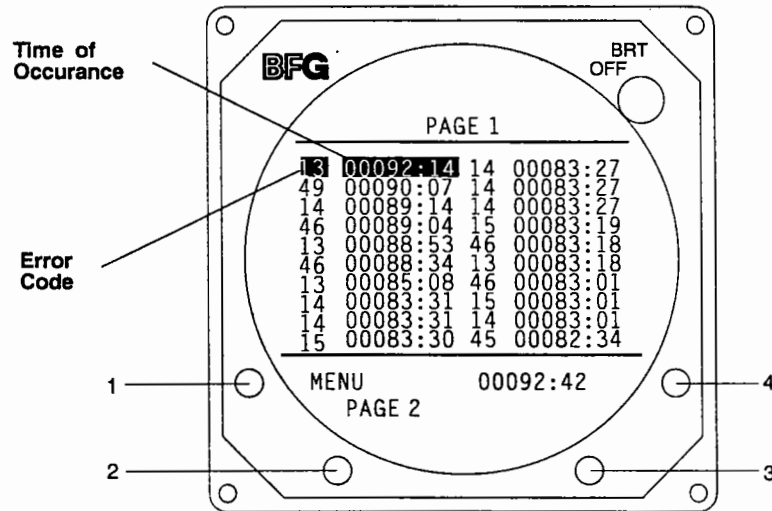


Figure 3-21. Fault Log Page 1

Buttons 1 and 2 in figure 3-21 perform the following functions (buttons 3 and 4 are not used):

1. **MENU** switches the display back to the Service Menu (figure 3-19).
2. **PAGE 2** switches the display to page 2 of the Fault Log.

Page 1 of the Fault Log lists the error codes of the 20 most recent system faults and the times at which they occurred.

1. The times are listed in hours and minutes.
2. The times are the elapsed run times at which the faults were detected.

For example: Error code 13 was detected 92 hours and 14 minutes after power was initially applied to the system and is the most recent fault detected. Error code 14 was detected three times 83 hours and 27 minutes after power application.

The total elapsed run time since the *Stormscope* system was installed is indicated in the button 4 legend area.

Pressing the **PAGE 2** button will cause PAGE 2 of the Fault Log to appear in the display. (This screen is intended primarily for BFG FlightSystems Service Technicians to determine a fault history for future analysis.) Page 2 of the Fault Log is shown in figure 3-22.

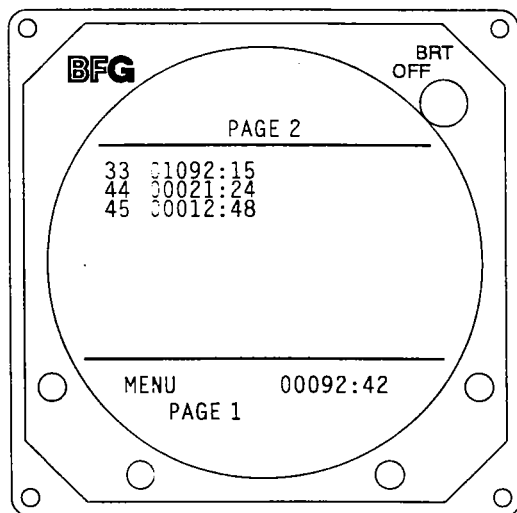


Figure 3-22. Fault Log Page 2

Buttons 1 and 2 in figure 3-22 perform the following functions (buttons 3 and 4 are not used):

1. **MENU** switches the display back to the Service Menu (figure 3-19).
2. **PAGE 1** switches the display back to page 1 of the Fault Log.

Page 2 of the Fault Log lists only the run time of the first occurrence of the displayed error code. Some error codes displayed on page 1 may not appear on page 2.

1. The times are given in hours and minutes.
2. The times are the elapsed run times at which the faults were detected.

The total elapsed run time since the *Stormscope* system was installed is indicated in the button 4 legend area.

3.5.3 Noise Tests Mode

Pressing **SELECT** with Noise Tests high-lighted on the Service Menu (figure 3-19) will cause the **NOISE MONITOR** screen to appear. The **NOISE MONITOR** display is shown in figure 3-23.

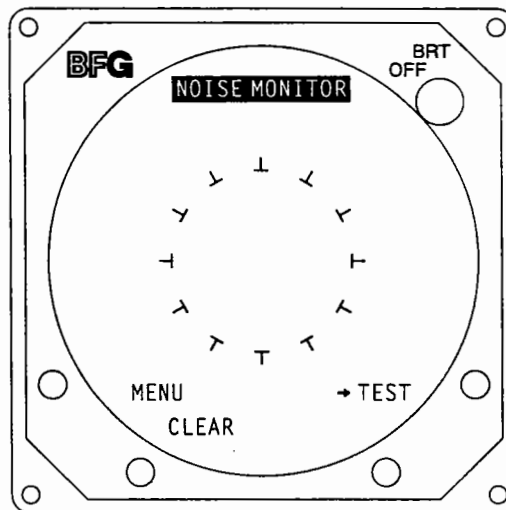


Figure 3-23. Noise Monitor Presentation

The buttons perform the following functions (figure 3-23):

1. **MENU** returns the display to the Service Menu (figure 3-19).
2. **CLEAR** erases all noise indications from the display.
3. (No function.)
4. **TEST** switches the display to the **TEST STRIKE** screen.

The **NOISE MONITOR** screen displays indications of electrical noise as well as legitimate electrical discharge activity that occurs within 400 nautical miles. It is checked to see if electrical noise is present that will interfere with normal system operation. The operator should press **CLEAR** to erase the screen and then check for electrical noise indications.

1. **PASS** - There should normally be no noise indications inside the ring on the display. (A small number of single, random noise points inside the displayed ring is acceptable.)
2. **FAIL** - Significant activity (strike clusters) or persistent indications of electrical noise inside the ring are unacceptable. (Corrective action is discussed in Maintenance Section 5.7.3H, Interference Tests.)

If the noise monitor test is satisfactory, the operator should press the **TEST** button to switch to the **TEST STRIKE** display. The **TEST STRIKE** display is shown in figure 3-24.

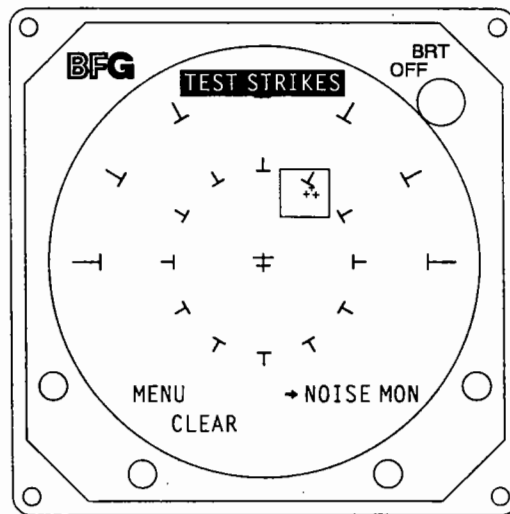


Figure 3-24. Test Strike Presentation

The buttons perform the following functions in this screen (figure 3-24):

1. **MENU** switches the display back to the Service Menu.
2. **CLEAR** erases the noise indications.
3. **NOISE MON** switches the display back to the **NOISE MONITOR** screen.
4. (No function.)

The **TEST STRIKE** screen checks the placement accuracy of electrical discharge data processed and plotted by the *Stormscope* system. This display should be cleared occasionally to ensure that the strike indications are being generated as required. A strike indication ("+") should appear inside the displayed box each second.

1. **PASS** - In *Stormscope* systems with version 3.00 or higher software, the strike indication is displayed and cleared each second, so that it appears to flash. In *Stormscope* systems with earlier versions of software, the strike indications are superimposed and must be cleared manually.
2. **FAIL** - This test is failed if the generated strike indications appear outside of the box, or do not appear at all.

Switch back and forth between the **NOISE MONITOR** and **TEST STRIKE** displays to check for electrical noise that could interfere with weather mapping and for accurate plotting of the internally generated test strikes.

NOTE

The system must pass both the Noise Monitor and Test Strike criteria to ensure proper operation.

3.5.4 Test Disable Mode

Pressing **SELECT** with Test Disable high-lighted on the Service Menu (figure 3-19) will cause all the *Stormscope* system self-tests to be discontinued.

1. When the Test Disable feature is activated (self-tests turned off), a warning message will appear in the Main Menu and in all weather mapping displays.

An example of the Test Disable Message is shown in figure 3-25.

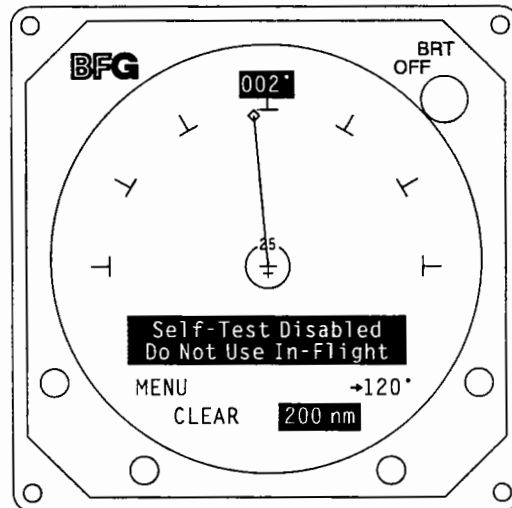


Figure 3-25. Test Disable Message

2. This mode should be used when the *Stormscope* system is connected to test equipment (WX-PA) which replaces the antenna.

If the self-tests are not disabled, extraneous error messages may appear, since the system antenna is not connected.

3. The Main Menu appears after the Test Disable function is activated.

CAUTION

The Test Disable mode should be used when troubleshooting *Stormscope* system problems in the aircraft, but not during normal in-flight operations. (See Troubleshooting in Maintenance Section 5.) The diagnostics that warn of improper system operation are not active.

The *Stormscope* system must be switched off, and then back on, to restore all the self-test functions. The warning message will disappear.

3.5.5 Expansion Data Mode (Navaid Option Installed)

Pressing **SELECT** with Expansion Data high-lighted on the Service Menu (figure 3-19) will cause the **EXPANSION DATA** display to appear.

1. The Expansion Data screen displays the Loran receiver and communications interface that has been selected.
2. The Loran receiver should be the one installed in the aircraft.
3. The communications interface (RS-232C or RS-422) is selected with a DIP switch on the Expansion Interface PCB. (See Maintenance Section 5.5, ADJUSTMENTS.)

The **EXPANSION DATA** display is shown in figure 3-26.

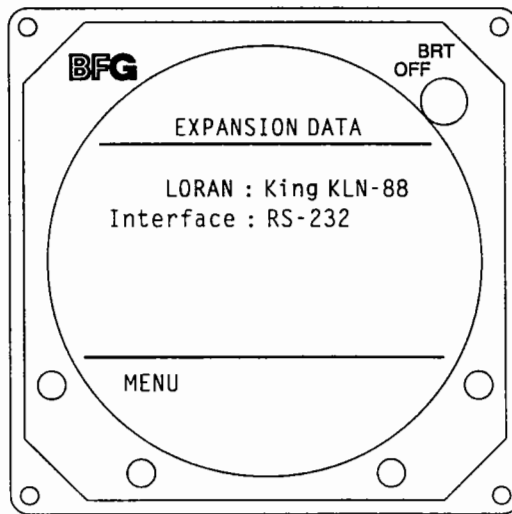


Figure 3-26. Expansion Data Presentation

Only button 1 (**MENU**) is functional in this display. (Buttons 2, 3, and 4 are not used.) **MENU** switches the display back to the Service Menu.

3.5.6 Expansion Tests Mode (Navaid Option installed)

Pressing **SELECT** with Expansion Tests high-lighted on the Service Menu (figure 3-19) causes the first EXPANSION TESTS display to appear.

1. The first screen prompts the operator to set up the system properly for the testing that will be performed. This display is shown in figure 3-27.

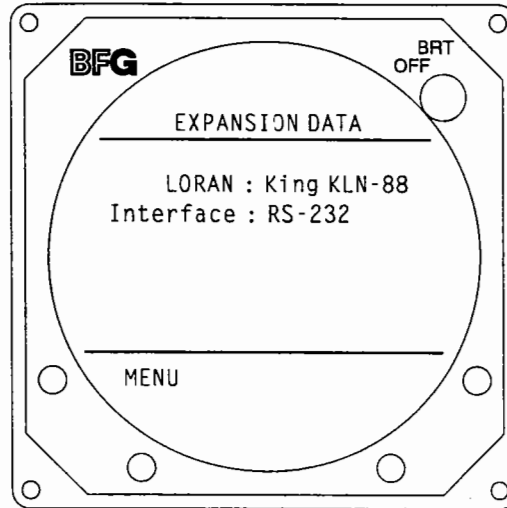


Figure 3-27. Expansion Tests - Screen 1

Buttons 1 and 4 on the first EXPANSION TESTS screen (figure 3-27) provide the following functions (buttons 2 and 3 are not used):

1. **EXIT** switches the display to the Service Menu.
2. **TEST** switches the display to the second EXPANSION TESTS screen.

This screen enables the operator to test the Navaid communications circuitry. The results of the testing are indicated in the display. The buttons on the second EXPANSION TESTS screen (figure 3-28) provide the following functions:

1. **EXIT** switches the display to the Service Menu.
2. **START** begins the testing of the communications interface.
3. **STOP** ends the testing of the communications interface.
4. (No function.)

When **START** is pressed, the Loran communications interface is tested at one second intervals until the **STOP** button is pressed, or until **EXIT** is pressed to return to the Service Menu (figure 3-19).

1. While testing is in progress, a high-lighted "TESTING" is displayed on the screen.
2. When the testing has been stopped by pressing the **STOP** button, a high-lighted "STOPPED" replaces the "TESTING" message.
3. The result of each test is displayed as "< OK >" or "< FAULT >."

An example of the screen with the high-lighted "TESTING" and an "< FAULT >" test result is shown in figure 3-28.

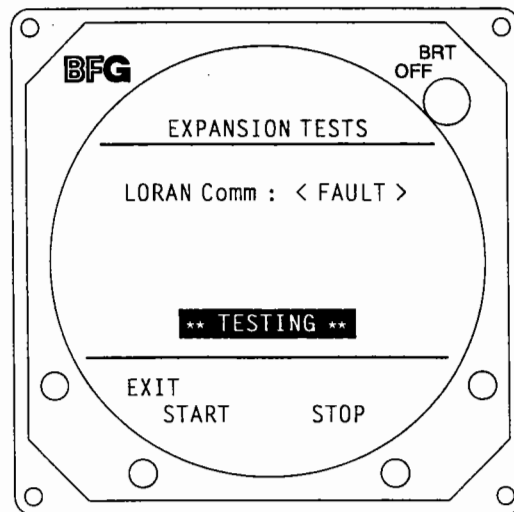


Figure 3-28. Expansion Tests - Screen 2

3.5.7 LORAN Setup Mode (Navaid Option Installed)

NOTE

Loran setup must be performed to select the proper Loran. The Navaid Option will not operate if the proper Loran is not selected.

Pressing the **SELECT** button when LORAN Setup is high-lighted on the Service Menu (figure 3-19) will cause the LORAN Setup mode to be displayed. All of the Loran receivers qualified by BFG FlightSystems (at the time of purchase) to interface with the Navaid Option in the *Stormscope* processor are listed here.

The buttons perform the following functions in this display (figure 3-29):

1. **MENU** switches the display back to the Service Menu.
2. **NEXT** moves the highlight bar down to the next Loran model on the list.
3. **PREV** moves the highlight bar up to the previous Loran model on the list.
4. **SELECT** enters the high-lighted Loran receiver as the one to be connected to the *Stormscope* Series II system.

A large dot is displayed on the left side of the Loran receiver that is currently selected as the one that is interfaced to the *Stormscope* processor. Figure 2-29 shows the dot and the highlight bar in the LORAN Setup display.

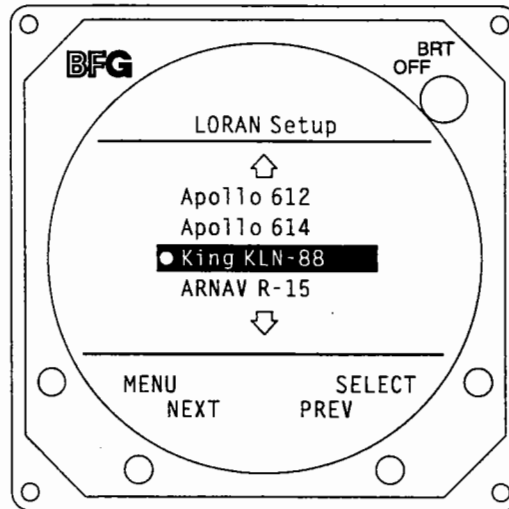


Figure 3-29. LORAN Setup Presentation

When **SELECT** is pressed, one of two things will occur.

1. If the communication parameters for the selected Loran receiver can not be changed by the operator, the display will blink once and the large dot will appear to the left of the high-lighted Loran.
2. If the communication parameters for the selected Loran can be changed by the operator, the display proceeds to the LORAN Parameters Screen.

The LORAN Parameters display enables the operator to select the processor interface communication parameters to match those of the Loran receiver being used.

NOTE

If the Loran model number was supplied when the Navaid system was ordered, the proper communications specification (RS-232C or RS-422) will already be selected. If the Loran communication parameters have not been previously modified, the default values listed on the LORAN Parameters screen can be used. If, however, the Loran model to be interfaced was not known, or it was changed, or the Loran default parameters have been modified (to interface with a fuel computer, etc.), it will be necessary to change the parameters of the processor interface to match those of the Loran.

The LORAN Parameters display is shown in figure 3-30.

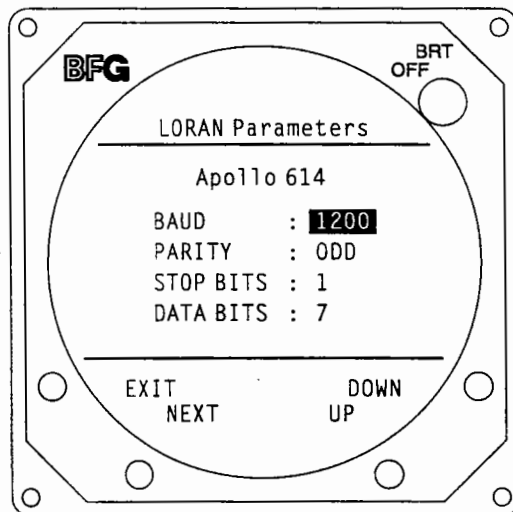


Figure 3-30. LORAN Parameters Presentation

The buttons provide the following functions in this screen (figure 3-30):

1. **EXIT** switches the display back to the Service Menu (figure 3-19).
2. **NEXT** moves the highlight bar to the next parameter value field.
3. **UP** increases the selected parameter value by one increment.
4. **DOWN** decreases the selected parameter value by one increment.

The increments of change for the parameter values are:

1. BAUD - 300, 600, 1200, 2400, 4800, 9600, 300, etc.
2. PARITY - ODD, NONE, EVEN, ODD, etc.
3. STOP BITS - 1, 2, 1, etc.
4. DATA BITS - 5, 6, 7, 8, 5, etc.

3.5.8 LORAN RAW DATA Mode

Pressing the **SELECT** button when LORAN Raw Data is high-lighted on the Service Menu (figure 3-19) will cause the LORAN RAW DATA mode to be displayed. There is an empty box in the middle third of the display at this point.

The buttons perform the following functions:

1. **MENU** switches the display back to the Service Menu.
2. **START** begins the display of hexadecimal data character groups received from the Loran.
3. **STOP** stops the display of additional character groups.
4. (No function.)

When **START** is pressed and Loran communications data is being received, a "RECEIVING" message will appear in the button 4 legend area, and the hexadecimal character groups will start filling the display, from left to right, a line at a time, starting in the top left corner. When the screen fills, the first character groups displayed are replaced sequentially by incoming data. Figure 3-31 shows a full display of character groups and the receiving message.

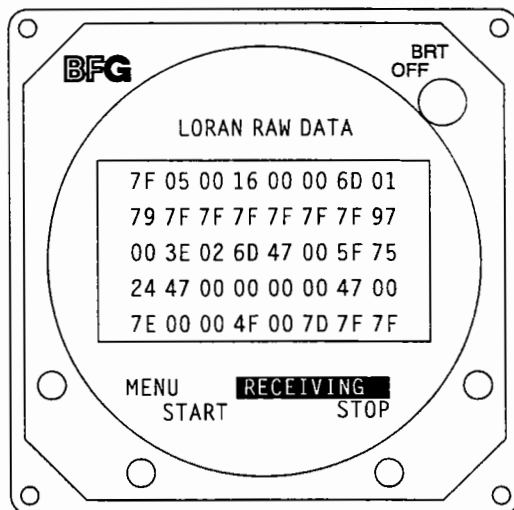


Figure 3-31. LORAN RAW DATA Presentation

If **STOP** is pressed, the last data group received will be high-lighted. (All the data below the high-lighted byte preceded the data above it and have not yet been replaced.) Figure 3-32 shows the display with the Loran data stopped.

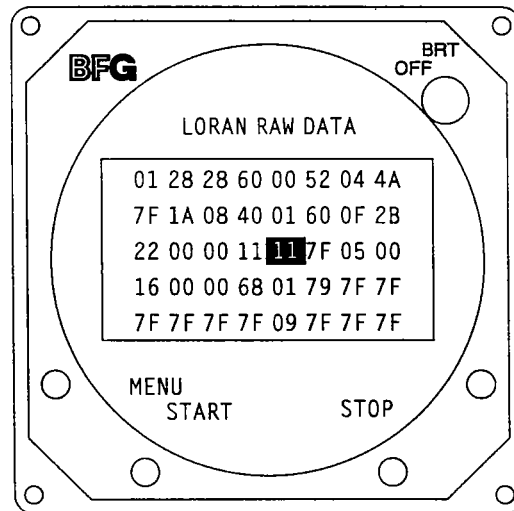


Figure 3-32. LORAN RAW DATA Stopped

If a character group in the sequence is not received within five seconds, a "DATA TIMEOUT" message appears in place of "RECEIVING." Figure 3-33 shows the LORAN RAW DATA display with the "DATA TIMEOUT" message.

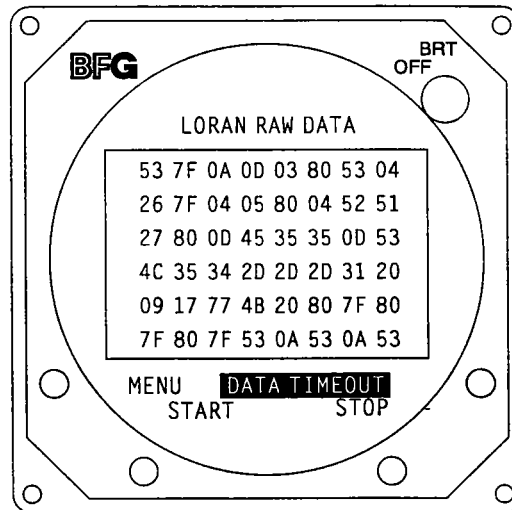


Figure 3-33. LORAN RAW DATA Timeout

CHAPTER 4

THEORY OF OPERATION

4.1 INTRODUCTION

Thunderstorms have long been regarded as one of aviation's most severe weather hazards.

Weather radar may provide much information about precipitation in thunderstorms, but not necessarily indicate the most severe areas. Furthermore, it is difficult, and many times impractical, to install weather radar in general aviation aircraft.

Map electrical discharge activity and you'll map the thunderstorm.

Thunderstorms by definition contain electrical discharge activity. It has been well established that as electrical discharge activity increases, the potential risk of severe turbulence due to convective wind shear also increases. Locate and plot the electrical discharges and you map the thunderstorm.

Anatomy of a thunderstorm

Within the thunderstorm, strong updrafts and downdrafts occurring close together produce a separation of positive and negative charges. When enough of these charges accumulate, electrical discharges occur. A few of these discharges are visible as lightning. But for every discharge that can be seen there may be a hundred more hidden in the clouds that are not seen.

All electrical discharges radiate electromagnetic radio frequency energy in all directions. Find the magnetic discharges, determine their range and azimuth and you can accurately map thunderstorm locations.

The WX-1000 and WX-1000+ systems utilize advanced technology to map thunderstorm activity. All thunderstorms emit powerful electromagnetic and electrostatic signals. A typical lightning discharge of 20 to 30 thousand amps generates a field signal of about 5 volts/meter at 100 nautical miles. The character of the field signals varies considerably.

1. Intra-cloud electrical discharges are the most prevalent and thus produce a significantly greater number of field signals. These are often characteristic of building or dissipating thunderstorm cells.
2. Cloud to ground lightning discharges, although less frequent than intra-cloud activity, are significant because their strength is typically greater than the intra-cloud discharges.
3. Cloud to cloud lightning is generally least monitored by *Stormscope* systems due to the predominantly horizontal direction of the discharge.

All of the *Stormscope* models utilize principles similar to an ADF (Automatic Direction Finder) for azimuth determination.

The WX-1000 and WX-1000+ Series II systems consist of three major components: the antenna, the processor, and the display.

4.2 ANTENNA

The antenna is an aerodynamically designed, flat pack, combined crossed loop-and-sense antenna. The antenna receives both the electric and magnetic fields emitted from lightning that is generated by all thunderstorms. Differential drive amplifiers are used for each of the X and Y loop signals and also for the sense antenna for the electric field. Built into the antenna are test generators to continuously verify proper antenna performance of each of the antenna sections.

4.3 PROCESSOR

The processor utilizes analog processing to detect, discriminate, sample, hold, and convert the signals to digital format. The digital signal components are further processed using software algorithms to isolate the types of signals and determine both range and azimuth. Heading stabilization from a gyro is converted from X, Y, Z synchro to digital format and processed digitally. The process time for each discharge is less than 2 milliseconds. Since a flash of lightning may have many discharges, the entire flash may last for up to a second. The display processing utilizes both a 68000 microprocessor and a video system controller to generate the various screens controlled by the four buttons from the display. The screens are produced on four different planes; one for stationary graphics, one for background and two for rotating graphics. The display screen is software controlled and may also be expanded with hardware to produce other integrated functions.

The processor has built-in auto-test and diagnostics functions including antenna, analog processing, program, video and data memories, heading flag, clock battery, and stuck mic key (over one minute). Complete tests are conducted during power up and may also be operator initiated. Six of the primary functions are continuously tested several times per minute during normal system operation.

The processor also contains the system power supply. The power supply provides regulated + 5 volts, + 15 volts and -15 volts electrically isolated from the battery input (10.5 to 32 volts). Its input is fuse and diode protected from reversed applied power. It also has current limit protection.

4.4 DISPLAY

The display has a high resolution (256 x 256), raster-scan 3 inch diameter cathode ray tube (CRT) that may be installed in a 3ATI cutout in the aircraft instrument panel. It receives its video, horizontal sync (16,390 HZ), and vertical sync (60Hz) from the processor. The basic circuit functions similarly to a conventional monochrome monitor except that it uses balanced input drives. The four buttons control the processor functions for the various displays. The power switch is coupled to the brightness control. The power supply requires regulated +15 volts and -15 volts from the processor. A high voltage supply of 10KV is produced by a flyback circuit to provide a high contrast display that is visible in normal daylight conditions.

CHAPTER 5

MAINTENANCE

5.1 INTRODUCTION

This section contains information needed for a BFG FlightSystems authorized *Stormscope* dealer to test a complete, interwired system and to isolate a fault to the processor, display, or antenna, or to the aircraft interconnect wiring.

5.2 PERIODIC MAINTENANCE

NOTE

Upon delivery of a *Stormscope* Series II Weather Mapping System to a customer, the dealer should recommend an annual checkout of the system, especially prior to the thunderstorm season.

5.3 BENCH TEST

The bench test is performed with the *Stormscope* system out of the aircraft. It should be performed as part of the incoming inspection of equipment, and as part of the troubleshooting process to help isolate the source of a problem to a component or to aircraft interconnect wiring. The initial bench test is also the time to enter the aircraft registration number and customer furnished checklists into the *Stormscope* system processor memory.

NOTE

The warranty card supplied with the product must be completed and returned to BFG FlightSystems by the initial retail owner within 15 days of delivery of the installed product to effect warranty coverage. The responsibility for proof of warranty lies with the owner of the equipment. To aid in validating a system's warranty status in the event of factory repair, the aircraft registration number should be entered as item #1 on each WX-1000/WX-1000+ checklist page.

5.3.1 Equipment Required

A. System components to be tested:

1. One of the following:

Processor, Model WX-1000 - P/N 78-8060-5790-3, or
Processor, Model WX-1000+ - P/N 78-8051-9160-4
Processor, Model WX-1000E (WX-1000+ with Navaid Option) -
P/N 78-8060-5941-2

2. Display - P/N 78-8060-5900-8
3. Antenna - P/N 78-8051-9200-8 (optional for test)

B. Stormscope Series II Bench Kit:

1. Connector Pod - P/N 78-8060-5750-7
2. Antenna Cable - P/N 78-8060-5802-6
3. Communications Test Plug - P/N 78-8060-5925-5 (Navaid or ARINC-429 options)

C. Portable Analyzer Kit (WX-PA) - P/N 78-8060-5791-1

D. DC Power Supply: 12 to 28 VDC, 30W, or equivalent (not supplied).

E. Ground Plane: 25 inch x 25 inch (65 cm x 65 cm) minimum, 1/16 inch (1.6 mm) aluminum. (Not Supplied)

5.3.2 Self-Test Disable

The WX-1000/1000+ self-test feature should be disabled to prevent extraneous error messages prior to performing the following procedures:

1. Bench Test without the WX-1000/1000+ antenna.
2. Performance testing of installed units.

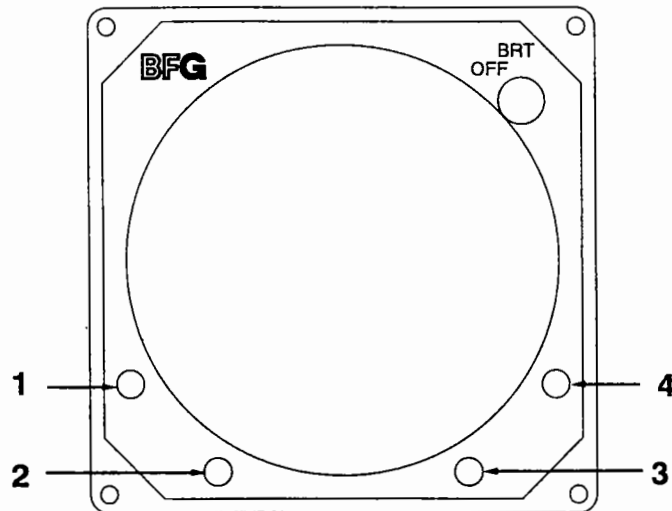
NOTE

The WX-PA simulates all signals except ANTTSTHI and ANTTSTLO (see figure 2-19 System Interconnect in the Installation Section). The WX-PA, therefore, cannot simulate test strike data during the system self-test and an "ERROR 45" will be displayed if the self-test is not disabled.

CAUTION

The WX-1000/1000+ self-test should never be disabled for in-flight use except for troubleshooting purposes. When the self-test feature is disabled, the diagnostics that warn of improper system operation are not active.

The WX-1000/1000+ self-test feature is disabled as follows:



NOTE

The processor software version is indicated on the connector end of the processor.

1. Processor Software Version 1.21 or lower.
 - a. Depress and hold display Button 4 when turning the system on. (The button may be released after 5 seconds or after text appears on the display.) The following message is displayed:

SELF-TEST DISABLED
 - b. Press any button to restore normal operation. (The self-test function is reset, the message disappears, and the Main Menu button legend is displayed.)
2. Processor Software Version 2.00 or higher.
 - a. Depress display Buttons 1 and 2 (left two buttons) while turning the system on. (The buttons may be released after 5 seconds or after text appears on the display.) The Service Menu should appear.
 - b. Press the display button labeled **NEXT** until Self-Test Disable is highlighted.
 - c. Press the display button labeled **GO**.

NOTE

The self-test feature may be restored by recycling power to the system (turning the system off, then back on).

5.3.3 Bench Setup

A. Site Selection

1. Select a location for the bench test that is free from electrical interference that may affect system performance and cause faulty test results.
 - a. During the bench test, the system antenna should be at least the distances indicated from known sources of electrical interference such as:
 - TV monitors - 20 feet
 - Computer terminals - 20 feet
 - Computerized phone systems - 5 feet
 - Fluorescent or mercury vapor lights - 5 feet
 - System display unit - 5 feet
 - Bench power supplies - 5 feet
 - Oscilloscopes - 5 feet
 - b. Use a BFG FlightSystems Skinmapper (P/N 78-8060-5859-6) to verify that the selected bench antenna location is free of electrical interference. (See figure 5-1.)

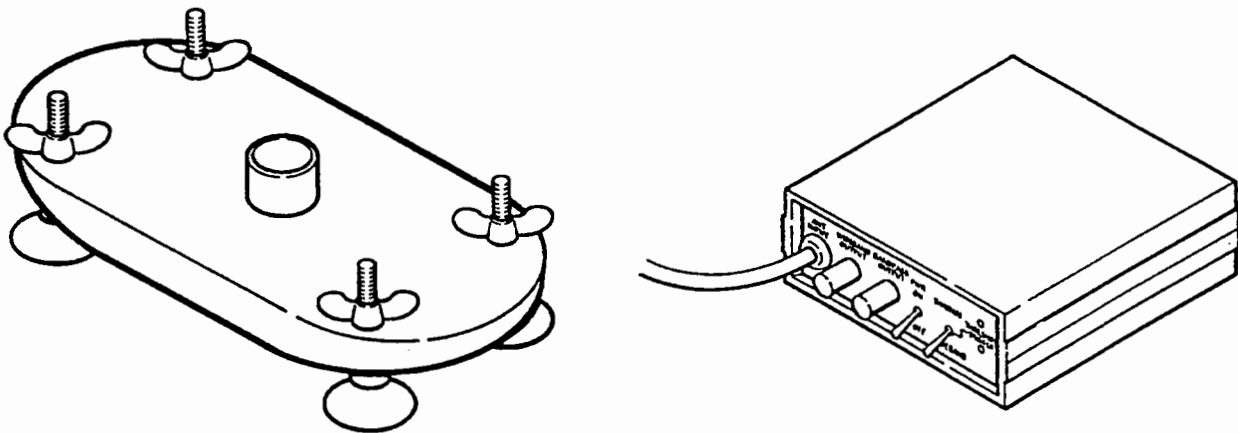


Figure 5-1. Skinmapper

NOTE

The WX-SM Skinmapper consists of an antenna, a 20 foot cable, and a console that emulates the *Stormscope* system processor. The primary use of the Skinmapper is to locate or verify a noise-free location for installing the system antenna on an aircraft. It is also useful in selecting testing locations and in troubleshooting electrical noise problems. The console amplifies signals received from its antenna and provides visual and audible alarms when the antenna output exceeds acceptable limits. The console also provides outputs that enable the signal from the antenna to be viewed with a dual trace oscilloscope if desired.

Skinmapping should not be performed in areas near power lines, underground cables, or operating ground power units. Thunderstorm activity within 300 nautical miles can cause random indications of noise on a monitoring oscilloscope. Figure 5-2 shows a typical Skinmap hookup.

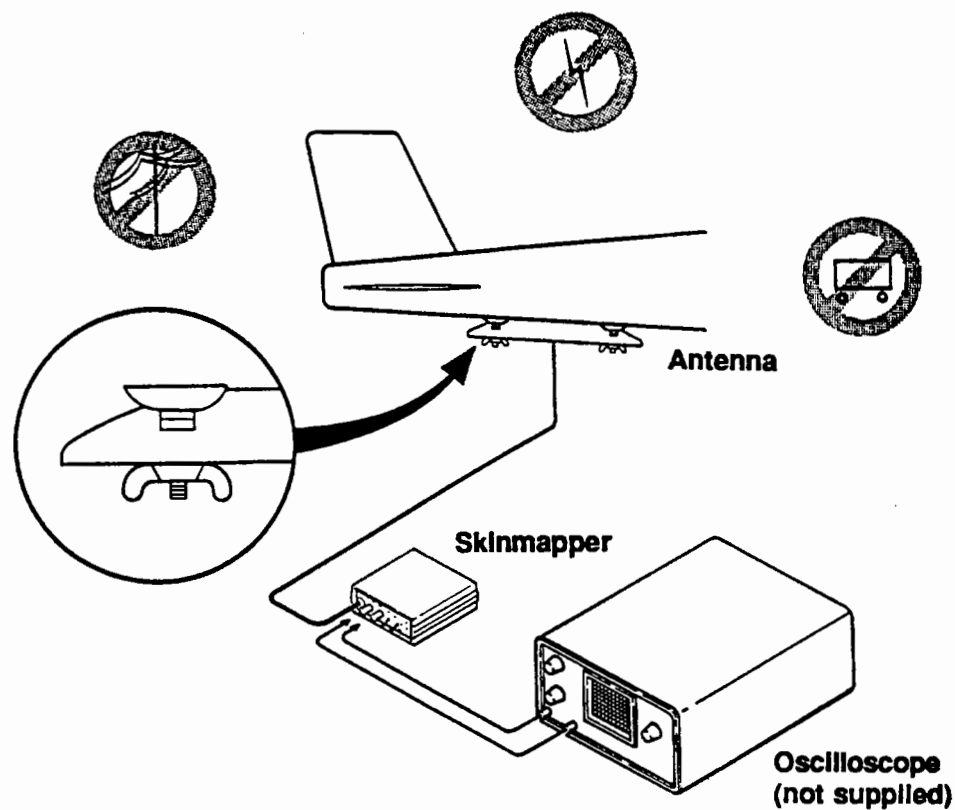


Figure 5-2. Skinmap Hookup

B. Equipping the Site

Ensure that the bench test location has all the required test equipment and is supplied with appropriate power.

C. Initial Hookup is shown in figure 5-3.

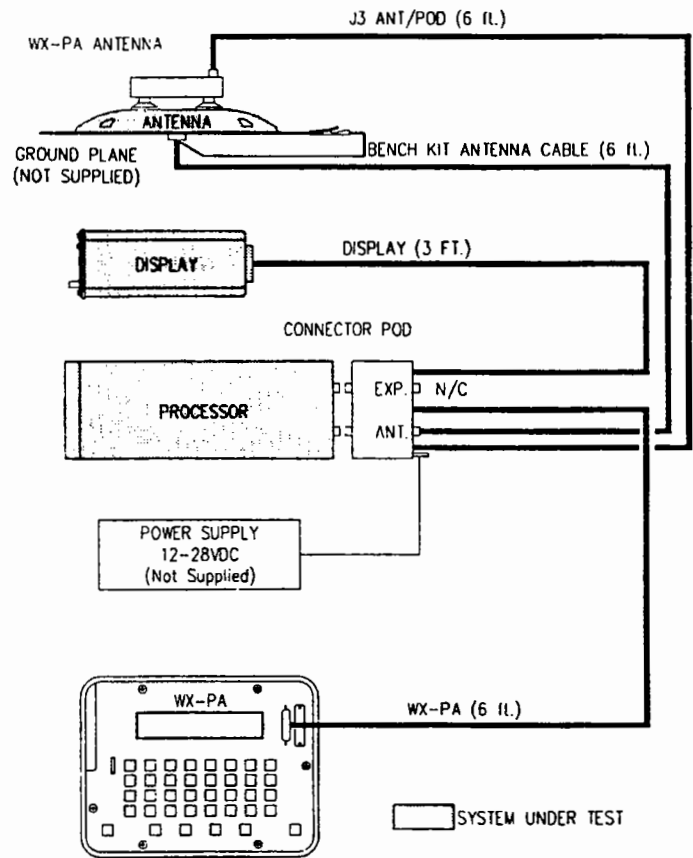


Figure 5-3. Bench Setup With Antenna

CAUTION

Do not apply power until all system interconnections have been made. Early power application may result in damages to the *Stormscope* system.

1. Connect the bench kit pod to the rear of the *Stormscope* system processor box. Ensure that the pod is aligned with the processor and that the pins make a secure electrical contact. (Substantial pressure is required to make this connection.)
2. Double check the connections to make sure the plugs are completely seated before proceeding.
3. Connect the display cable from the pod to the cockpit display unit and secure it in place with the sliding lock on the display connector.
4. Connect the pod's WX-PA cable to the WX-PA portable analyzer and secure it with the sliding lock on the WX-PA connector.

D. Final Hookup With the Antenna

A ground plane must be used when performing a bench test of a *Stormscope* system with the antenna attached (Installation Section 2.4.4).

1. Mount the antenna to the ground plane using the four long screws provided in the hardware kit. (The nuts are not supplied.)

NOTE

The ground plane provides a reference for the sense section of the antenna.

2. Connect the 6 foot bench test antenna cable to the pod and secure it with the sliding lock. (Do not use the 25 foot WX-PA antenna cable, P/N 78-8060-5763-0, when bench testing.) See figure 5-3.
3. Connect the antenna cable circular plug to the antenna and connect the alligator clip to the ground plane. (Refer to figure 5-3.)

NOTE

If the system is not grounded, performance will be affected and test results will not be reliable.

4. Position the WX-PA antenna onto the system antenna.
 - a. Wet the suction cups for maximum adhesion.
 - b. Align arrow symbols so that the WX-PA antenna is centered on the system antenna. (This is necessary for proper response.) See figure 5-4.

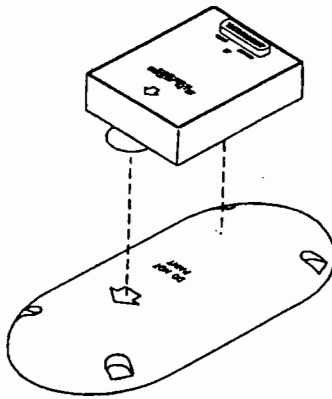


Figure 5-4. WX-PA Antenna Alignment

5. Connect the J3 antenna pod cable to the WX-PA antenna. (Refer to figure 5-3.)
6. Connect the battery charger to the WX-PA unit, and plug the charger into a wall receptacle.

NOTE

The WX-PA can run without external power for short periods of time (2 to 4 hours). The charger should be used whenever possible, however. If the batteries are completely discharged, they will not recharge and will have to be replaced. There is no drain on the battery when the charger is being used. The charger may be left plugged in indefinitely, as there is protective circuitry to prevent overcharging the battery.

CAUTION

Make sure the power supply is off when connecting it to the pod. Early power application may damage the *Stormscope* system.

7. Connect the bench power supply (12-24 VDC, 30W) to the pod.
8. Power up the WX-PA by pressing the PWR button.
 - a. The WX-PA will perform a series of self-tests to verify that all of its functions are operating properly.
 - b. The Mode Menu will appear on the screen if the WX-PA passes all the self-tests. (See figure 5-5.)

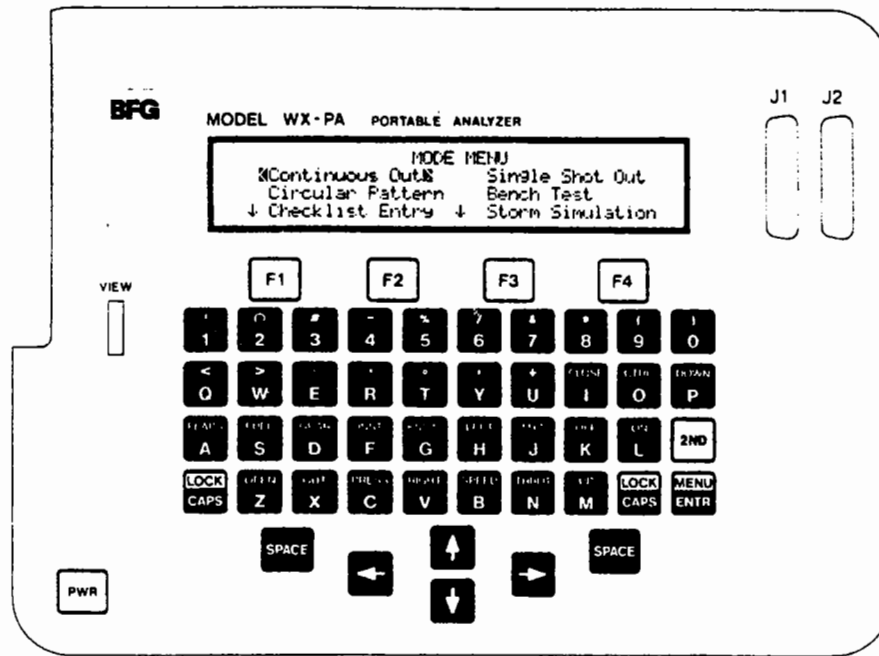


Figure 5-5. WX-PA Control Panel

- c. If the WX-PA did not pass all of the self-tests, the functions that failed will be displayed.
9. Verify that the pod is still firmly attached to the processor and power up the *Stormscope* system.
 - a. Switch on the bench power supply. (not supplied)
 - b. Switch on the *Stormscope* system with the OFF/BRT control on the display.

NOTE

The *Stormscope* systems will not operate if the power supply polarity is not correct.

10. Allow the display unit to warm up for a few seconds, then adjust the brightness.
 - a. If the *Stormscope* system's self-tests are all passed, the Main Menu will be displayed.
 - b. If a fault message appears instead of the Main Menu, power down the display, recheck all the connections, and try again.

NOTE

If a processing problem persists, it may be necessary to move the antenna and ground plane away from sources of electrical interference. Possible interference sources include the cockpit display and the WX-PA portable analyzer. Use the WX-SM Skinmapper connected directly to the antenna on the ground plane to aid in relocation to a noise free area.

E. Final Hookup Without the Antenna.

This practice is common if the antenna has been eliminated as a possible cause for a malfunction being investigated. The system processor and display can easily be removed from the aircraft and taken to a bench for more convenient testing (The antenna cannot be easily removed.)

If the system antenna is not going to be tested, the WX-PA will be hooked up to drive the processor directly (see figure 5-6). The *Stormscope* system self-test functions must be disabled as described in section 5.3.2 to prevent the detection of a self-test error. (The WX-PA will not simulate strike test data during the system self-test, resulting in an "ERROR 45" being displayed.)

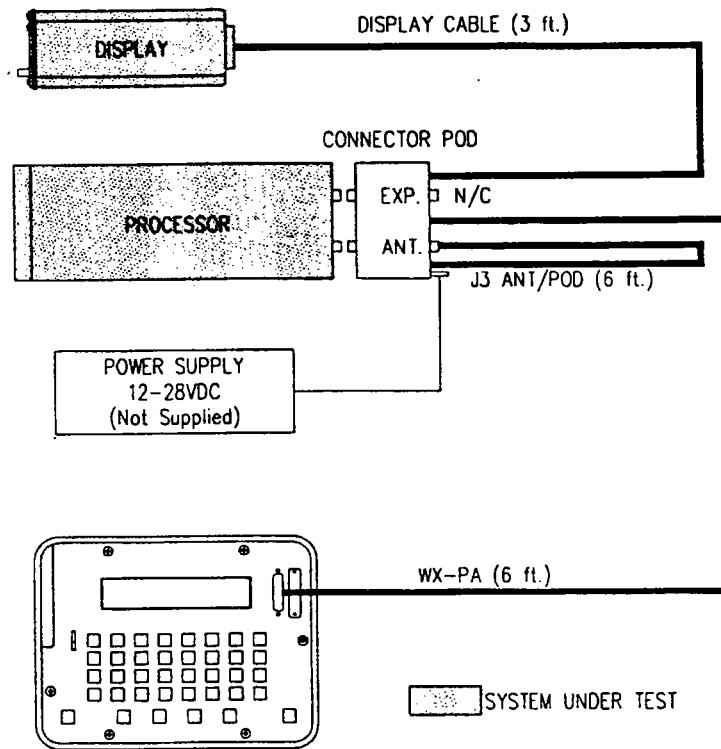


Figure 5-6. Bench Setup Without Antenna

CAUTION

Do not apply power until all connections have been made. Early power application may damage the *Stormscope* system.

1. Connect P3 from the bench kit pod to J3 on the bench kit pod. (See figure 5-6.)
2. Connect the battery charger to the WX-PA unit, and plug the charger into a wall receptacle.

NOTE

The WX-PA can run for short periods of time (2 to 4 hours) without external power. The charger should be used whenever possible, however. If the batteries are completely discharged, they will not recharge and will have to be replaced. There is no drain on the battery when the charger is being used. The charger may be left plugged in indefinitely, as there is protective circuitry to prevent overcharging the battery.

CAUTION

Make sure the power supply is off when connecting it to the pod. Early power application may damage the *Stormscope* system.

3. Connect the bench power supply (12-24 VDC, 30W) to the pod.
4. Power up the WX-PA.
 - a. The WX-PA will perform a series of self-tests to verify that all of its functions are operating properly.
 - b. The Mode Menu will appear on the screen if the WX-PA passed all the self-tests.
 - c. If the WX-PA did not pass all of the self tests, the functions that failed will be displayed.
5. Verify that the pod is still firmly attached to the processor and power up the system.
 - a. Switch on the bench power supply.
 - b. Switch on the *Stormscope* system with the OFF/BRT control on the display.

NOTE

The *Stormscope* system will not operate if power supply polarity is not correct.

6. Allow the display unit to warm up for a few seconds, then adjust the brightness.

F. Navaid Setup (if installed)

If your system does not contain the Navaid Option, proceed to section 5.3.4.

In order to communicate with a specific Loran receiver, the *Stormscope* Navaid Option must be set up to accept the particular transmission format of that specific Loran. There are two basic areas in which the Expansion Interface board for the Navaid Option must be tailored to the target Loran.

The first difference among Loran receivers is the communications electrical specification. Most Lorans utilize the RS-232C communications specifications. As of October, 1990, the only qualified exceptions to this were the Northstar M1 and the Trimble Navigation Loran/GPS receivers, which utilize the RS-422 communications specification. The Expansion Interface board is capable of supporting both communications types. Selecting between RS-232C and RS-422 communications on the Navaid Option board requires changing a switch located on the board.

The second difference is that Lorans transmit the navigational data in different formats. To tailor the Navaid Option to a specific Loran data format requires the use of one of the Series II system Service Mode procedures.

If a Loran model number was supplied when the Navaid Option system was ordered, the Navaid Expansion Interface board should be set for the proper communications specification (RS-232C or RS-422). In this case, it will require no switch setting changes. However, if the Loran model was not known at the time of the order, or if it has changed, the switch setting on the Expansion Interface board may need to be changed.

Perform the following steps to ensure that the Navaid Option is ready for bench testing.

1. Hold the *Stormscope* system display buttons 1 and 2 (the left two buttons) depressed while switching the display on.

The buttons must be held for five seconds or until text appears in the display. The Service Menu will appear.

2. Move the highlight bar to LORAN Setup and press the SELECT button.

The Loran receivers that are currently qualified to interface with the Navaid Option are listed on the screen.

The currently selected Loran receiver is indicated by a large dot to its left side.

3. Move the highlight bar to the correct Loran receiver and press SELECT. If the communication specification is not set correctly for the selected Loran, an "Incorrect Switch Setting" message will appear in the display. (The correct switch setting will also be displayed.) If this message appears, it is necessary to change a DIP switch selection on the Navaid Option Expansion Interface printed circuit board (PCB). Refer to Section 5.5, ADJUSTMENTS. If no error message is displayed, the correct communications specification is selected.

If the communication parameters of the selected Loran are not operator adjustable, the display will blink once, and the selected Loran will be marked by the large dot. At this point, the setup procedure is complete, and the Navaid Option is ready to be bench tested.

If, however, the selected Loran model allows the communication parameters to be modified, additional setup of the Navaid Option might be required. In this case, the LORAN Parameters mode will automatically be displayed showing, for example:

```
BAUD: 1200
PARITY:      EVEN
STOP BITS:   1
DATA BITS:   7
```

The parameters listed on this screen are the factory default settings for the particular Loran selected from the LORAN Setup mode. They generally do not require changing. However, if the Loran communication parameters have been modified in order to connect to a fuel computer, or some other system, the Navaid Option communication parameters can be modified in this mode to match them. The current parameter settings of the Loran must be checked to determine if they have been modified. The Service Manual for the particular Loran receiver will tell how to perform this check.

4. Set the displayed Navaid Option communication parameters to match those of the interfaced Loran receiver and press EXIT. The Navaid Option is now ready to be bench tested.

5.3.4 Bench Test Procedure

A. Select Bench Test

Select Bench Test from the WX-PA Menu (figure 5-5) and press **MENU/ENTR**. The blinking cursor is moved with the arrow keys.

B. Select the Model Number

Select the model number to be tested from the Model Menu (WX-1000+ or WX-1000) and then press **MENU/ENTR**.

1. The WX-1000/1000+ will display "TEST MODE" until all tests are complete and power is recycled.
2. The WX-PA will test the following items, reporting any faults found, and giving possible causes:
 - a. ROM
 - b. RAM
 - c. EEPROM
 - d. VRAM- During Video Ram test, a series of blinking dots appear across the display.
 - e. RTC Battery
 - f. Real Time Clock
 - g. Inhibit Line
 - h. Heading Flag (WX-1000+ only)
 - i. Gyro Processing (WX-1000+ Only)
 - j. Strike Processing

C. Follow the WX-PA prompts to press the WX-1000/WX-1000+ display buttons.

Press **MENU/ENTR** on the WX-PA after each display button is pressed.

D. Follow the WX-PA prompt to disconnect the antenna.

1. Disconnect the WX-1000/WX-1000+ antenna cable from the bench pod and then press MENU/ENTR. The WX-PA will test for an antenna fault condition.
2. This test is performed even if an antenna is not included in the bench test.

E. Failed Bench Test

1. If any of the items listed in B.2 fails the bench test, follow the instructions displayed by the WX-PA.
2. Check the possible causes of reported faults and correct them if possible (see Fault Isolation in Section 5.3.5).
3. If there is a system failure indicated on the display during the bench test, perform the following procedure:
 - a. Power down the system.
 - b. Recheck all connections.
 - c. If possible, move the antenna to a location where there is less RF interference.
 - d. Power up the system and repeat the bench test.
4. If there is a reason to suspect that faults occurring during bench testing may be caused by the WX-PA, refer to Section 5.4.4, WX-PA Output Verification Test.

F. When the bench test procedures are complete, the WX-PA will display "Bench Test Completed".**G. Common problems encountered during bench testing:**

1. Poor connections between the bench kit connector pod and the processor.
2. Antenna connector ground line WX-1000/WX-1000+ that is not connected to the ground plane. (This will cause an error in the strike processing test.)
3. Antenna that is too close to RF noise source. (This will cause an error in the strike processing test.)
4. WX-PA antenna that is not properly oriented on the WX-1000/WX-1000+ System antenna. (This will cause a strike processing test failure.)
5. WX-1000/WX-1000+ self-test that is not disabled when the system antenna is not being tested. (This may cause a strike processing test failure.)

NOTE

The WX-PA simulates all signals except ANTTSTHI and ANTTSTLO (see figure 2-19 System Interconnect). The WX-PA, therefore, cannot simulate test strike data during the system self-test and an "ERROR 45" will be displayed if the self-test is not disabled.

H. Navaid Option Bench Test

(If the Navaid Option is not installed, proceed to Section 5.3.5.)

The bench setup required is the same as that outlined in Section 5.3.3, except that the WX-PA does not have to be connected. If it is already connected, it can be switched off.

1. Enter the Service Mode by powering up the *Stormscope* system while holding display buttons 1 and 2 depressed.
2. Press NEXT until the highlight bar on the Service Menu is on Expansion Data, then press SELECT.
3. Verify that the communications protocol DIP switch on the Expansion Interface PCB is set correctly (RS-232C or RS-422), and that the communications interface parameters of the Navaid Option match those of the Loran receiver.

NOTE

Refer to Section 5.5, ADJUSTMENTS if the communications protocol is not set correctly for the Loran receiver being used.

4. Move the highlight bar to Expansion Tests on the Service Menu and press SELECT.

The Expansion Tests mode will display the prompt:

ATTACH EXP TEST PLUG
TO BENCH TEST POD P302

Press Test to continue

5. Connect the communications test plug (FlightSystems P/N 78-8060-5925-5) to the bench test pod connector marked N/C in figures 5-3 and 5-6. (This is connector P302.)

The communications test plug consists of a 25 pin D connector attached to a small printed circuit board (represented by figure 5-7). There is a switch on the board that must be positioned for the appropriate communications protocol (RS-232C or RS-422).

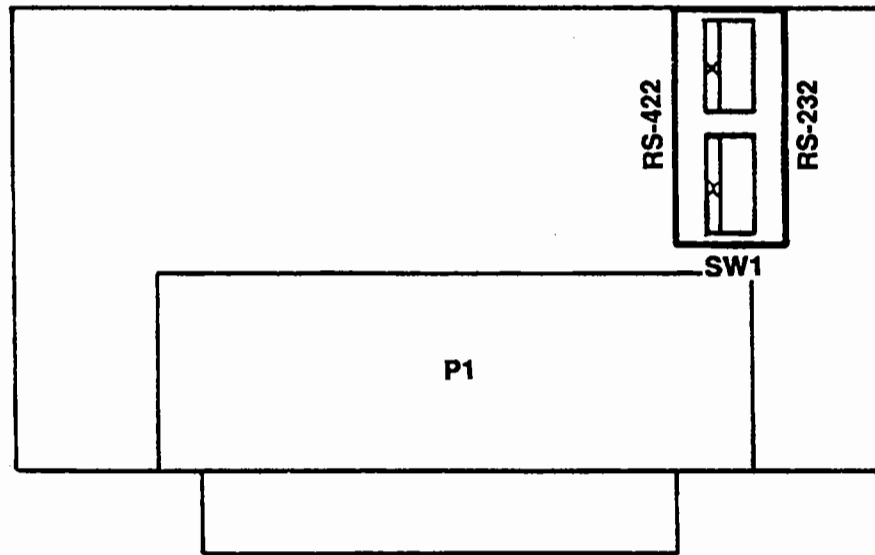


Figure 5-7. Communications Test Plug

6. Press TEST, then press START.

The system will begin testing the communications function once each second. "TESTING" will appear in the center of the display and the results of the last test will be shown as:

LORAN comm: < OK >

or

LORAN comm: < FAULT >

The ERROR message indicates a malfunction in the system or an improperly configured communication test plug (RS-232C, RS-422).

7. Press STOP to discontinue the testing.

If the LORAN comm test was < OK >, no further checks are required. The bench test is complete.

5.3.5 Fault Isolation

If a fault message reappears consistently when retesting, the fault must be isolated. This process is a vital part of troubleshooting procedures and often consists of no more than a logical assessment of what is working and what is not.

A. Two examples of fault isolation are given in the following paragraphs.

1. Symptom: No video on WX-1000/WX-1000+ display:

If no video appears on the WX-1000/WX-1000+ display, yet the system passes the video portion of the bench Test, then the display must be faulty.

2. Symptom: Strike Processing Test Failure:

Usually this failure is caused by one of the items listed at the end of the test procedure (Section 5.3.4.). If all of these items have been checked and eliminated as possible causes, or if the antenna cannot be placed in an area free of electrical interference, set up for a bench test without the antenna (Section 5.3.3E) and repeat the strike processing test.

If the test still fails, the processor is at fault. If the test passes, then the antenna or antenna location may be at fault.

NOTE

It is important to minimize excessive electrical interference during testing, because it can cause a strike processing fault.

B. Resolution

1. Isolate a *Stormscope* system problem to the processor, display or antenna.
2. Refer to Section 5.8, TROUBLESHOOTING, for further localization.

5.4 ADDITIONAL GROUND TESTS

5.4.1 Continuous Out Test

This test ensures that the *Stormscope* system processor can read and output a series of test strikes at various selected ranges and bearings. The test must be performed using at least the four cardinal headings (000, 090, 180, 270) and ranges of 35, 75, and 120 nautical miles. Perform the following procedure to complete the continuous out test: (Refer to the WX-PA Instruction Manual for details.)

1. Select the 200 nm range on the cockpit display.
2. Select Continuous Out on the WX-PA Mode Menu and press the MENU/ENTR key.

The Continuous Out mode display will identify the antenna location and *Stormscope* series number, and the selected range and bearing at which test strikes will appear. (Make sure the antenna and system selections are correct.)

3. Select 000 degrees and 120 nm on the WX-PA display.

Function keys F1 and F2 change the displayed range. Function keys F3 and F4 change the displayed bearing by 30 degree increments.

4. Press MENU/ENTR on the WX-PA to initiate the test.

A series of strike points (one per second) will be placed at the range and bearing selected. The strike points should be within 10% of the selected range and 5 degrees of the selected bearing. Figure 5-8 shows the proper display for this test.

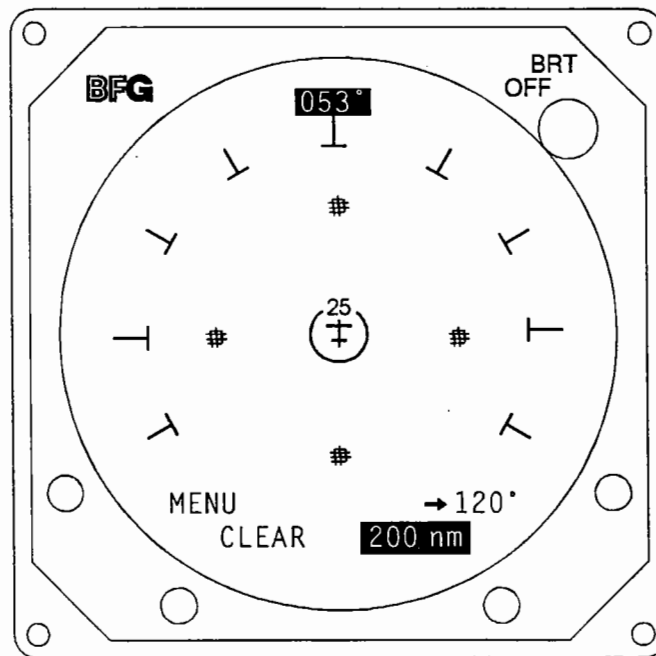


Figure 5-8. Continuous Out Test Display

5. Repeat the test at 090, 180, and 270 degree bearings.
6. Select 100 nm on the cockpit display.
7. Decrease the range to 75 nm on the WX-PA and verify that the test strikes now appear at 75 nm on the 270 degree bearing. (The range can be adjusted while the test is in progress).
8. Repeat the test at the 000, and 090, and 180 degree bearings.
9. Select 50 nm on the cockpit display.
10. Decrease the range on the WX-PA to 35 nm and verify that the test strikes now appear at 35 nm on the 180 degree bearing.
11. Repeat the test at the 270, 000, and 090 degree bearings.
12. Press 2ND and then MENU/ENTR to stop the test.

NOTE

The WX-PA is a system function tester only. It is not to be considered as a calibration standard.

5.4.2 Circular Test

This test ensures that the *Stormscope* system processor can read and output a series of test strikes at a selected range in continuously incremented bearings. This test must be performed using ranges of 30, 75, and 120 nautical miles (Refer to the WX-PA Instruction Manual for details.)

1. Select 200 nm on the cockpit display.
2. Select Circular Pattern from the WX-PA Mode Menu and press the MENU/ENTR key. The circular Pattern mode will indicate the *Stormscope* series number, antenna location, range and bearing increment locations.
3. Select a range of 120 nm, a bearing increment of 45 degrees, and press MENU/ENTR to initiate the test. Function keys F1 and F2 change the range. Function keys F3 and F4 change the bearing increment.

The WX-PA will automatically cycle through the bearings (every 45 degrees) placing test strikes at a range of 120 nautical miles. Figure 5-9 shows the proper display for this test.

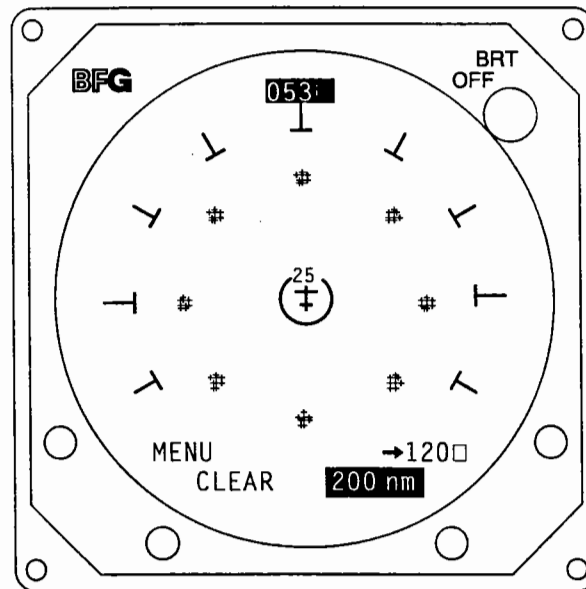


Figure 5-9. Circular Test Display

Ranges should be within 10 percent of the selected value, and bearings should be within five degrees.

4. Select 100 nm on the cockpit display.
5. Reduce the ranges selected on the WX-PA to 75 nm and check the test strikes on the full cycle of bearings. (The range can be adjusted while the test is in progress.)
6. Select 50 nm on the cockpit display.
7. Reduce the range selection on the WX-PA to 30 nm and check the test strikes on the full cycle of bearings.
8. Press 2ND and then MENU/ENTR on the WX-PA to end the test.

5.4.3 Storm Simulation Test

This test ensures that the processor can read and output a series of test signals that simulate a storm at a selected range and bearing. (The test can also be used to demonstrate the *Stormscope* Series II weather mapping system to potential customers.) See the WX-PA Instruction Manual for details.

1. Select Storm Simulation from the WX-PA Mode Menu and press MENU/ENTR.

The Storm Menu appears, giving a choice of storm types to be simulated. Pressing MENU/ENTR again advances the WX-PA presentation to the Storm Simulation Mode.
2. Select aircraft speed and heading and press MENU/ENTR to start the test.
3. Observe the cockpit display to ensure that a thunderstorm presentation is being plotted.
4. Press 2ND, then MENU/ENTR on the WX-PA to end the storm simulation and return to the Mode Menu.

NOTE

The WX-PA is a system function tester only. It is not to be considered as a calibration standard.

5.4.4 WX-PA Output Verification Test (Oscilloscope Required)

This test ensures that the WX-PA outputs during the *Stormscope* system bench tests and ground tests are correct. An oscilloscope is required to perform the output verification test. See the WX-PA Instruction Manual for details.

1. Perform the output verification test only when there is reason to suspect that faults occurring during testing may be caused by the WX-PA.
2. Send a WX-PA that does not pass the output verification test to BFG FlightSystems Product Support Department for service.

5.5 ADJUSTMENTS

A. Stormscope System

The model WX-1000/WX-1000+ weather mapping system is factory calibrated and no field adjustments are required or authorized. Tampering with internal components may cause system failure and will void warranties.

B. Navaid Option

The communications specification (RS-232C or RS-422) for the interface between the Navaid Option and the Loran receiver in a particular aircraft is selected with a DIP switch on the Expansion Interface PCB. Perform the following procedure to change the DIP switch setting:

1. Remove power from the system.
2. Remove the five screws securing the cover (handle end) of the processor. (See figure 5-10.)

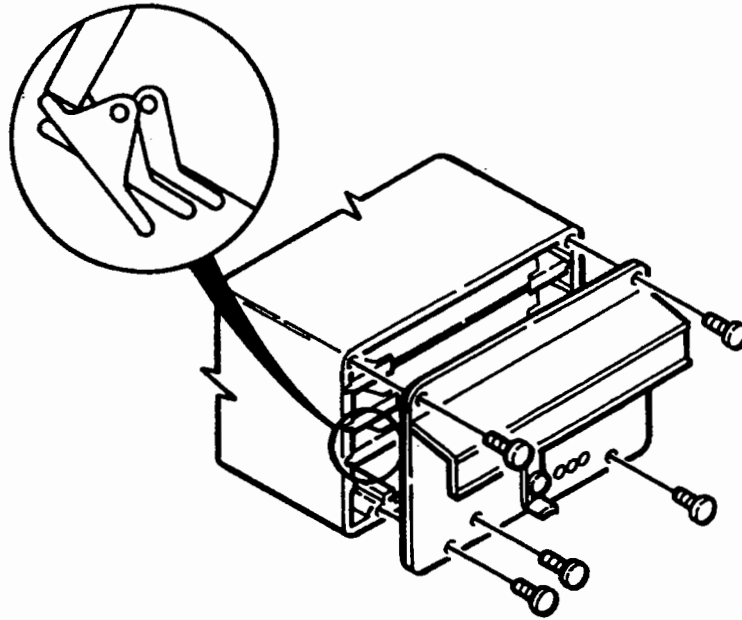


Figure 5-10. Removing Processor Cover

CAUTION

Components on the printed circuit boards contained in the *Stormscope* processor can be damaged by static discharge. To prevent this, always wear a static wrist strap and use a grounded mat when handling processor PCB's.

3. Use the levers (figure 5-10) on the corners of the Expansion Interface PCB to loosen the board for removal from the processor. (The Expansion Interface board is the third one from the top.)
4. Position the DIP switch shown in figure 5-11 to the appropriate selection (RS-232C or RS-422).

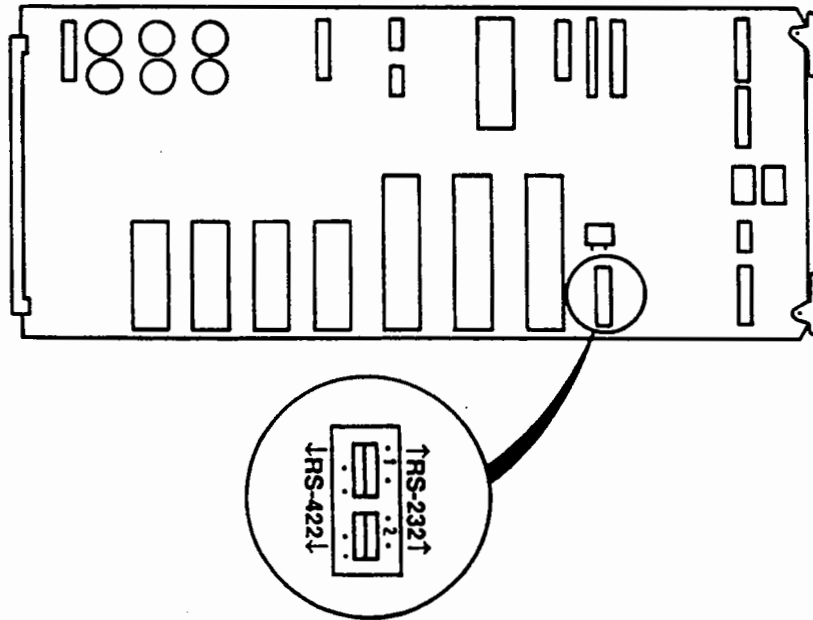


Figure 5-11. Expansion Interface PCB

5. Reinsert the board and replace the processor cover.
6. Check the Navaid Option setup as outlined in Section 5.3.3.F.

NOTE

The Loran receiver that is currently selected in the Navaid Setup mode of the Service Menu, and the communications specification selected by the DIP switch on the Expansion Interface PCB, can be checked at any time by selecting the Expansion Data mode from the Main Menu.

5.6 CHECKLIST ENTRY

Checklist entry is a unique feature of the *Stormscope* weather mapping system. It enables the storing of checklist information pertaining to emergency procedures, taxi and run-up, takeoff, climb, cruise, landing, or any other events the pilot wants programmed into the system.

NOTE

Checklist entries should be made only after the bench test and additional ground tests are complete. It is convenient to enter checklists when the processor and display are still set up and connected on the bench.

The system will accept six checklists with a title entry line and up to 30 item lines per Checklist. Title entry lines have a maximum length of 15 characters. Item entries have a maximum length of 20 characters.

The owner of the *Stormscope* Series II system must provide the completed checklists for entry. The aircraft registration number, and the checklist title should be provided for every checklist.

A. Initial Installation

NOTE

Only an outline of Checklist entering procedures is given in this manual. The WX-PA Instruction Manual should be consulted for details.

Perform the following steps to enter checklists into the system during initial installation:

1. Move the cursor to Checklist Entry on the WX-PA Mode Menu and press the MENU/ENTR key.

The Checklist Entry mode will appear on the WX-PA display.

2. Move the cursor to the Title position and press the MENU/ENTR key.
3. Type in the title of the first checklist and press MENU/ENTR to store the title in processor memory.

The system will automatically return to the Checklist Entry mode.

4. Move the cursor to the item position of the checklist and press MENU/ENTR on the WX-PA keyboard.

Specific checklist items can now be entered. MENU/ENTR is pressed at the end of each complete item to store it in the processor memory. When an item is stored, the cursor automatically moves to the next item line, up to line 30.

5. When the first checklist is complete, press 2ND and then MENU/ENTR to return to the title entry line to begin the next checklist.
6. Repeat the process until all the checklists are entered in memory.
7. When all the checklist entries are complete, press 2ND, and then press MENU/ENTR to return to the WX-PA Mode Menu.
8. Move the cursor to Checklist Entry and press the MENU/ENTR key to display the Checklist Entry mode.

The Checklist Title Edit and Checklist Item Edit modes can be used to review or modify the Checklists that have been entered in memory.

NOTE

The WX-PA Instruction Manual contains detailed description of checklist entry procedures and features. This material should be studied before entering checklists in the *Stormscope* system for the first time.

NOTE

After all the checklist entries have been made and verified, the installer and the customer should both sign the worksheets. The customer should keep one set on board the aircraft. The installer's copy should be kept on file (in case it is needed at a future date). A sample of the WX-1000/WX-1000+ Checklist Worksheet is included at the end of this section.

B. After Initial Installation

A display bypass plug is used when it is necessary to enter or modify checklists in a system where the display is installed in an aircraft. The display bypass plug (FlightSystems P/N 78-8060-5823-3) is included with all *Stormscope* Series II bench kits. Perform the following steps to enter checklists into a previously installed system (system in an aircraft):

1. Connect the *Stormscope* system processor and the WX-PA to the bench kit pod as outlined in Section 5.3.3.

2. Connect the display bypass plug to the bench kit pod cable labelled "DISPLAY".

The green LED power indicator on the system processor will illuminate.

3. Wait for one minute.

NOTE

If the *Stormscope* system antenna is not connected, the red LED fault indicator on the processor will come on. This is normal. If an antenna is connected, the fault indicator should be off.

4. Switch on the WX-PA and select the Checklist Entry mode.
5. Perform all desired checklist functions.
6. When finished, exit the WX-PA checklist mode and disconnect the display bypass plug to remove power from the *Stormscope* system.

5.7 PERFORMANCE TEST

The performance test is conducted with the system installed in the aircraft. The test will check for phase, azimuth and range response of the *Stormscope* system. It will also test for internal sources of electrical interference. This test is required after a system installation to verify customer acceptance of performance. It is also used to initiate further service testing or to verify a malfunction. The system performance test must be completed to ensure that the weather mapping system is operating according to specifications.

CAUTION

Every installation must be performance tested to ensure proper *Stormscope* operation. Failure to perform this testing could result in unsafe operation. Authorized dealers are required to do performance testing as a condition of their dealer agreement.

NOTE

The 25 foot WX-PA antenna cable must be used for performance testing. The length of the cable should enable the WX-PA to be inside the cockpit for all system checks. The antenna used in the WX-PA Portable Analyzer test system should have a "MOD A" label attached to the cover plate near the serial number. This sticker indicates that a wiring modification of the antenna has been done that improves the coupling of test signals into the *Stormscope* system antenna. This results in improved grouping, or clustering, of strike points when doing a system performance test. If the WX-PA antenna does not have a "MOD A" sticker, contact the *Stormscope* Product Support Department in Columbus, Ohio.

5.7.1 Equipment Required

A. One of the following:

1. Model WX-1000 System, P/N 78-8060-5780-4
2. Model WX-1000 + System, P/N 78-8051-9240-4
3. Model WX-1000E (WX-1000+ with Navaid Option) P/N 78-8060-5941-2

B. Model WX-PA Portable Analyzer, P/N 78-8060-5791-1

C. Navaid Option (if installed)

(The Navaid Option can be installed in a WX-1000+ system only.)

1. Expansion Interface PCB, P/N 78-8060-5894-3 (installed in processor)
2. Loran receiver

5.7.2 Options Jumpers

The jumpers that determine system options must be verified as follows:

1. Turn the *Stormscope* system off.
2. If the processor software version number is 2.00 or higher, depress and hold display Buttons 1 and 2 (left two buttons) while turning the system back on.

The Service Menu will appear with the System Data line high-lighted.

3. Press the display button labelled GO.

The system will read and display the status of the options jumpers.

4. Verify that the options jumpers are correct.

5. Press the display button labelled MENU to return to the Service Menu.

6. Once in the Service Menu, press the display button labelled EXIT.

The unit will complete the power-up self-test and return to the Main Menu.

7. Power down the avionics bus and the *Stormscope* system.

5.7.3 Performance Test Procedures

The performance test should always be conducted in a location that is known to be free of electrical interference (noise). If a location is being used for the first time, a WX-SM Skinmapper should be used to verify that it is electrically quiet.

A. Power Up

Turn on the master switch, avionics master, and the *Stormscope* system, and set the brightness control fully clockwise. (Allow about 30 seconds for warm-up). The system will perform a series of self-tests and then display the Main Menu.

If the Main Menu does not appear, or is distorted, or if a self-test error message is displayed, proceed to Section 5.8, TROUBLESHOOTING.

B. Brightness

1. Rotate the power/brightness knob fully counterclockwise and verify that the display is completely dark.

As the control is rotated clockwise, the display should begin to appear at about 1/4 turn.

2. Set the brightness at a comfortable viewing level.

C. Display Buttons

1. Press Display Button 2 (**NEXT**)

This should cause the highlight bar to move from Checklist to Time/Date.

2. Press Display Button 1 (**360°**)

This should cause the system to display the 360 degree Weather Mode.

3. Press Display Button 4 (**120°**)

This should cause the system to display the 120 degree Weather Mode.

4. Press Display Button 3 (**200 nm**)

This should cause the displayed range to change from "200 nm" to "100 nm".

5. If the buttons respond incorrectly, or not at all, proceed to Section 5.8, TROUBLESHOOTING.

D. Navaid Option Test (if installed)

(If the Navaid Option is not installed, proceed to E.)

This test checks the processing and display of information from the Loran receiver. The test procedures that follow assume that the Navaid Option has been setup to function with the Loran as outlined in the installation and setup procedures. If this has not been performed on the bench, it can be done in the aircraft. (Refer to section 5.3.3.F if necessary.)

Perform the following procedures:

1. Power up the Loran receiver and allow it time to acquire a Loran chain and display the current position.
2. After the Loran has acquired, select a Direct To to a nearby waypoint (within 50 to 100 nm).

The *Stormscope* Series II system will perform a series of self-tests, and then present the Main Menu. This normally indicates that the Navaid Option has synchronized with the Loran, and that communications between the two units is satisfactory.

NOTE

If the Navaid Option is not able to synchronize with the Loran, a Loran error message will appear instead of the Main Menu, or will replace the Main Menu a few seconds after it appears. If this occurs, or if no navigational data appears, troubleshooting should begin. (See Section 5.8, TROUBLESHOOTING.)

3. After the Main Menu has appeared, ensure that the Navaid Display status is "ON".

4. Press the 360 degree display button (button 1).

The 360 degree weather screen should appear, with the course line, waypoint, CDI, and digital navigation data displayed.

5. Check that the digital data on the display agrees with the data displayed by the Loran.

6. Check that the bearing and the range of the course line and waypoint agree with the range and bearing displayed by the Loran.

NOTE

If heading stabilization is not available due to a fault or heading FLAG condition, the course line will not be displayed.

E. Antenna Phase Check

This test verifies proper E-W and N-S orientation and the integrity of system wiring. The antenna phase check must be performed using at least the four cardinal headings (000, 090, 180, and 270) and using the following WX-PA ranges: 120, 75, and 30 nm. Refer to figure 5-12 for the test setup.

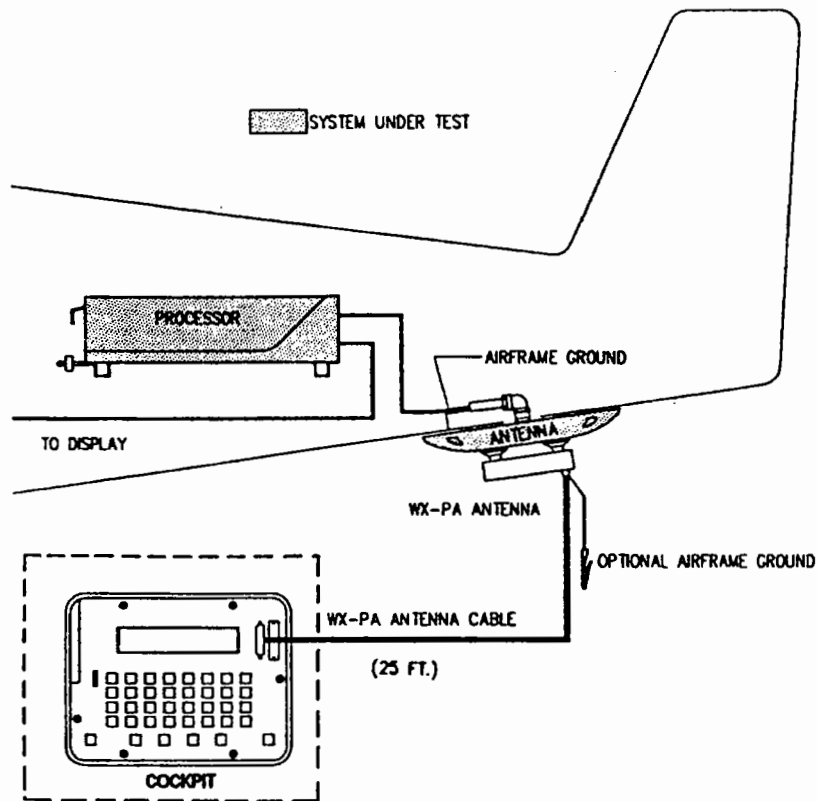


Figure 5-12. Aircraft Test Setup

Perform the following procedure:

1. Connect the WX-PA cable to the WX-PA antenna.
2. Position the WX-PA antenna on the system antenna, making sure the connection is tight, the arrow is pointed in the right direction, and that positioning is centered on the System antenna. (Refer to figure 5-4.)
3. Secure the WX-PA cable to the aircraft with the attached suction cup and route the cable to the cockpit.
4. Connect the remaining end of the WX-PA antenna cable to the WX-PA.
5. Power up the WX-PA.

6. Power up the *Stormscope* system while defeating the self-test (Section 5.3.2B) and select the 360 degree weather display from the Main Menu. (The default range will be 200 nm.)
7. Select the Continuous Out Mode displayed on the WX-PA menu and press MENU/ENTR.
8. Select a top mount or a bottom mount antenna configuration on the WX-PA keyboard, as appropriate.
9. Select a cardinal heading and a range of 120 nm.
10. Use the F1 and F2 keys to adjust range and the F3 and F4 keys to adjust bearing.
11. Press MENU/ENTER to start the test.

Adjustments to range and bearing can be made while the test is in progress.

12. Observe the display to ensure the proper positioning of the test strikes, based on range and azimuth settings on the WX-PA. (The strikes should be within 5 degrees of the selected azimuth and within 20% of the selected range.)

NOTE

The WX-PA is used only to check system functions. It is not considered a calibration standard.

13. After testing for all ranges and bearings indicated, press 2ND, then MENU/ENTER to return to the Main Menu.

F. Range and Azimuth Check

Range and azimuth plotting accuracy is checked by setting up the WX-PA to simulate a series of continuous strikes at 30 degree increments at ranges of 120, 55, and 15 nm.

Perform the following procedure:

1. Select Circular Output mode on the WX-PA Mode Menu (figure 5-5) and press MENU/ENTR.
2. Select a top mount or a bottom mount antenna configuration on the WX-PA keyboard, as appropriate.

The *Stormscope* display should be set at 200 nm on the 360 degree weather screen.

3. Use the F1 and F2 keys to select a 120 nm range and press "MENU/ENTR" to start the test.

The system should plot discharge points outside of the 100 nm range.

4. Observe the display to ensure the proper positioning of the test strikes.

The strikes should be within 5 degrees of the 30 degree azimuth increment and within 24 nautical miles (20%) of 120 nm.

NOTE

The WX-PA is used only to check system functions. It is not considered a calibration standard.

5. When complete, set the WX-PA for 15 nm, set the *Stormscope* display for 25 nm and repeat the test.

The System should plot points outside of the 12 nm range.

The strikes should be within 5 degrees of the 30 degree azimuth increment and within 3 nm (20%) of the 15 nm set on the WX-PA.

6. Repeat, setting the *Stormscope* display for 50 nm and the WX-PA for 25 nm.
7. Again, observe the display to ensure the proper positioning of the test strikes within 5 degrees of azimuth and 5 nm (20%) of the 25 nm set on the W-PA.

G. Interference Test

The electrical noise interference test is a critical part of post-installation performance testing. Its purpose is to ensure that interference from aircraft electrical systems and components is not affecting the *Stormscope* system's ability to perform properly. Electrical noise can be caused by any one, or a combination of, the following:

- Electrical interference being fed directly into the antenna.
- Grounding problems due to poor airframe bonding.
- Interference caused by a faulty aircraft system component.
- Excessive ripple on the A+ line to the processor.

Common sources of electrical interference are:

- Aircraft generators and alternators.
- Transponders and DMEs.
- Strobe light power supplies.

NOTE

(WX-1000+ Only)

The KG102 400 Hz inverter has been found to be a source of noise interference when used as a synchro heading reference. The noise may cause error 44 or 45 display messages, or extraneous strike points on the display. If proper processor grounding does not eliminate the problem, a 1k ohm, 5%, 1/4w resistor can be added in series with the H input to the processor. If this low pass filter does not solve the noise problem, it may be necessary to add a separate solid state inverter (e.g. A.C. Allen #23-1100-5A) as a reference source.

The interference test must be performed with aircraft engine(s) running, all electrical systems and avionics operating, and RPM sufficient (as high as practical) that aircraft generator(s) can carry the full

electrical load. Ideally this test should be conducted with a minimum of thunderstorm activity within a 400 mile radius. This procedure is equivalent to performing a skinmap after the installation is complete.

There are two interference test procedures. The one that is used depends on the processor software version of the system being tested. There is an interference test for systems with software version 2.00 or higher, and one for systems with version 1.21 or lower. (The test for version 1.21 and lower can be used for all WX-1000/WX-1000+ systems.) The software version is indicated on the rear of the processor near the serial number tag.

Interference test for software version 2.00 and higher only: (Refer to Operation Section 3.5.2.)

NOTE

This test may be performed with the aircraft in flight or on the ground, as long as it is running at high RPM with all systems powered. The WX-PA portable analyzer is not used for this test.

1. Select the Service Menu by turning on the display while depressing the two left buttons. Release the buttons only after the Service Menu appears on the display.
2. Move the highlight to the Noise Tests line using the NEXT button (figure 3-19), and then press the GO button.

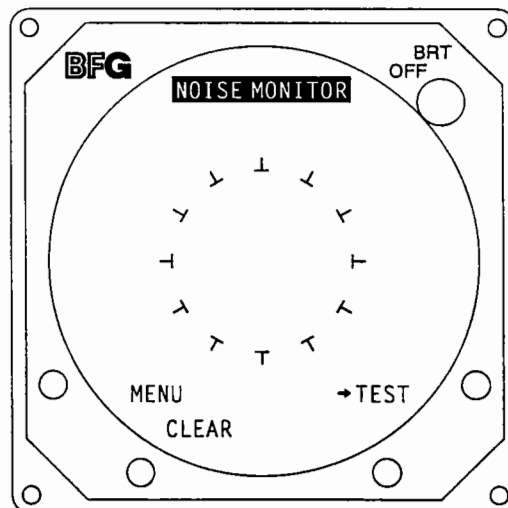


Figure 5-13. Noise Monitor Presentation

Strike points appearing on the displayed NOISE MONITOR screen represent ambient electrical noise, or thunderstorm activity within 400 nautical miles.

3. Determine if displayed strike points are caused by electrical interference in the aircraft.

Strike points caused by thunderstorm activity can be verified by changing the aircraft heading and clearing the display. Strike points caused by interference will reappear at the same position on the screen. Strike points due to thunderstorm activity will reappear at a new azimuth corresponding to the location of the storm.

NOTE

Some strike points outside the NOISE MONITOR screen's circle graticule are acceptable and usually will not affect system performance. Strike points inside the circle graticule, if caused by electrical interference, may affect system performance, as they may also appear in the weather mapping mode. Strike points caused by switch transients are acceptable if they do not reappear after clearing. A few non-clustered strike points inside the circle graticule are acceptable, as they will not affect the system's presentation of thunderstorm activity. Excessive strike points or clusters that appear inside the circle graticule due to interference can adversely affect operation of the *Stormscope* system.

4. Isolate any source of interference that will adversely affect system operation.

The offending interference source can be isolated by shutting down one system at a time, then clearing the display and observing for the reappearance of the strike points. When the problem system is shut down, the interference strike points disappear from the display. (Refer to section 5.8.4, Troubleshooting Electrical Noise.)

5. Press the display button labelled TEST to access the TEST STRIKES screen.

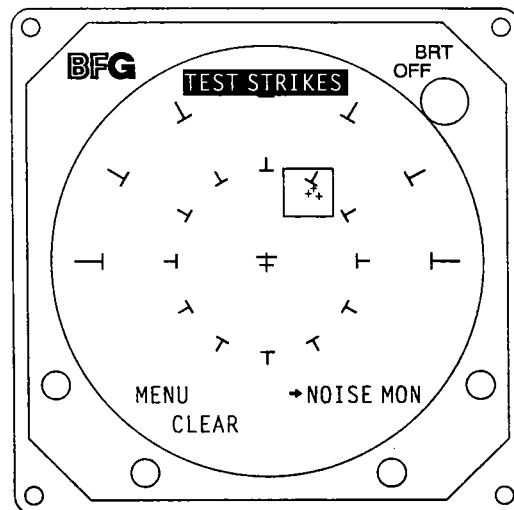


Figure 5-14. Test Strike Presentation

A box will appear in the upper right portion of the screen for a bottom mounted antenna, or in the upper left portion of the screen for a top mounted antenna. This represents the acceptance limits of the test strikes generated and processed by the system. The test strikes should occur within the box at the rate of one per second.

6. Clear the screen frequently, each time observing that the strike points reappear inside the box within one second. (Necessary for software version 2.00 only.)

Excessive electrical noise will delay or inhibit the appearance of strike points, or may cause the strike points to appear outside the box. (An occasional strike point outside the box is acceptable.)

7. Isolate the source of excessive electrical noise interference, as described previously. (Refer to Section 5.8.4., Troubleshooting Electrical Noise.)

8. Press MENU then EXIT when the noise test is complete.

The system will perform a self-test and then the Main Menu will appear in the display. To pass the interference test, a WX-1000/WX-1000+ system must pass the NOISE MONITOR TEST and the SELF-TEST as described above.

Interference test for all software versions:

This interference test must be used for Software Versions 1.21 and lower, and is acceptable for all other software versions. This test must be conducted on the ground since the WX-PA portable analyzer is attached to the aircraft antenna. The aircraft must be running at high RPM with all systems powered.

NOTE

This test should be conducted in a known "noise-free" area. A WX-SM Skinmapper can be used to verify that an area does not have excessive external electrical interference.

The equipment setup for this test is the same as for the antenna phase check, shown in figure 5-12.

1. With the WX-PA antenna attached to the aircraft antenna, route the analyzer cable to the cockpit and secure the cable to the aircraft.
2. Connect the analyzer cable to the WX-PA located in the cockpit.
3. With all aircraft systems operating and the engine(s) running at a high RPM, turn on the WX-1000/WX-1000+ system and the WX-PA Portable Analyzer.
4. Select the 200 nm and 360 degree weather mapping mode.
5. Set up the WX-PA to generate a Circular Pattern at 120 nm. (See Section 5.7.3F.)
6. Observe the display to ensure that a circular pattern of strike point clusters appears at 30 degree increments and 120 nm, clearing the screen each time the strike clusters begin repeating a given azimuth.
7. Ensure that strike point clusters appear in sequence, stepping to the next 30 degree azimuth at a constant rate.

Excessive electrical noise will inhibit or delay the appearance of strike point clusters or may scatter the strike point cluster. Extraneous strike point clusters may be caused by electrical interference or by thunderstorm activity within 200 nm.

8. If an error message appears, disable the self-test feature as described in Section 5.3.2B and repeat the test. (Error messages and causes are listed in Section 5.8.2.)
9. If excessive strike points are still present, determine if they are caused by electrical interference in the aircraft.

Strike points caused by thunderstorm activity can be verified by changing the aircraft heading and clearing the display. Strike points caused by interference will reappear at the same position on the screen. Strike points due to thunderstorm activity will reappear at a new azimuth corresponding to the location of the storm.

10. Isolate the source of interference that affects the appearance of the circular test pattern or generates excessive additional strike points.

The offending source may be isolated by shutting down one system at a time, then clearing the display and observing for proper response. (Refer to section 5.8.4, Troubleshooting Electrical Noise.)

11. Press MENU then EXIT when the noise test is complete.

The system will perform a self-test and then the Main Menu will appear in the display.

H. Transmitter Interference

1. With the *Stormscope* display on the 200 nautical mile range, key the aircraft communications radio microphone.
 - a. If strike data appears on the CRT when the transmitter is keyed, wire the inhibit line to the microphone key switch.
 - b. If more than one microphone is used, insert diodes as shown in Figure 2-19, System Interconnect in the Installation Section.

I. Inhibit

1. If the inhibit line is not connected, proceed to step K.
2. If there is data on the CRT, press the CLEAR display button while pressing the microphone key switch, and attempt to plot data using the WX-PA. (Continue holding the mic key for about 1 minute.)

The CRT should remain clear.

The message "MIC KEY STUCK" should appear on the display. The message will disappear upon release of the mic key.

J. Synchro Input (WX-1000+ Only)

1. To test the synchro functions, set the range on 200 nm, and use the WX-PA to plot discharge points on the CRT.
2. With the compass system turned on, physically turn the aircraft 45° to the right (or manually slew the compass), and verify that the discharge points move 45° counterclockwise.
3. Verify that the heading display tracks correctly.

K. Testing without the Antenna

If the system does not perform according to prescribed specifications, and the antenna is not suspected, performance testing can be conducted without the WX-PA antenna or system antenna connected.

Figure 5-15 shows the setup for performance testing without an antenna.

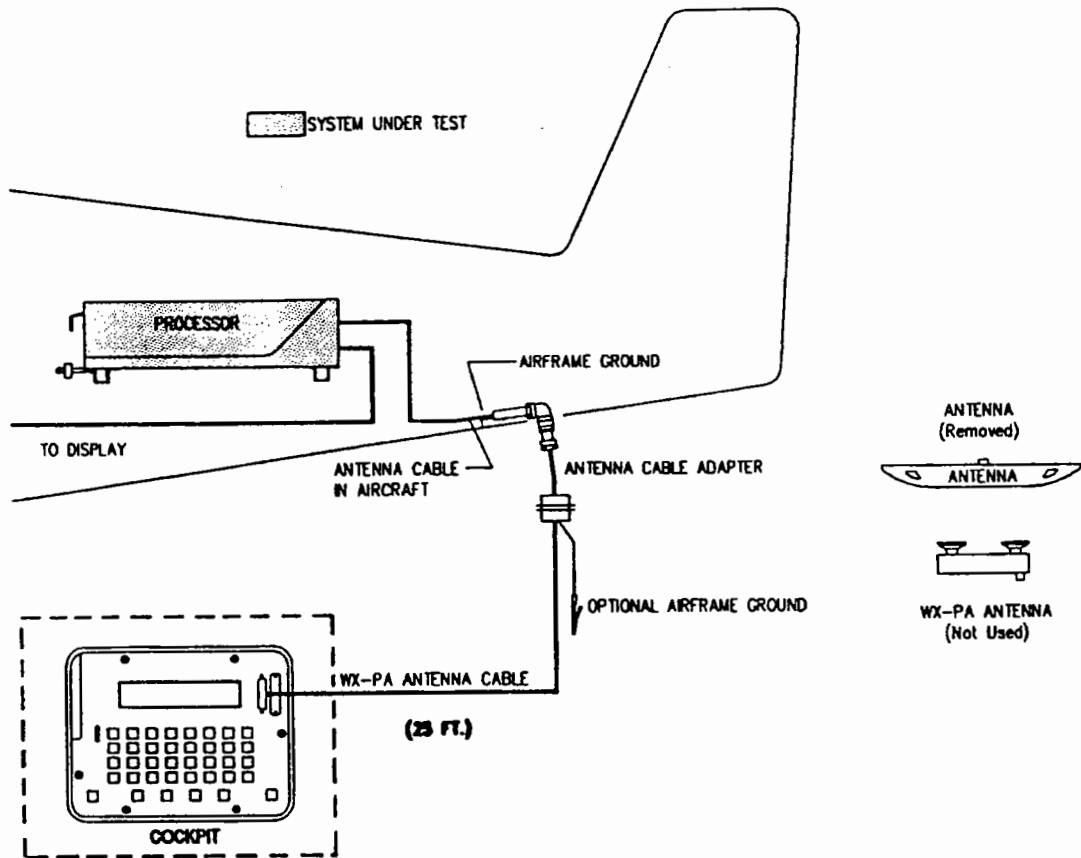


Figure 5-15. Test Setup Without an Antenna

Perform the following procedure:

1. Disconnect the *Stormscope* system antenna and the WX-PA antenna.
2. Connect the *Stormscope* system antenna connector directly to the WX-PA antenna cable, using the antenna cable adapter.
3. Complete a System Performance Test as already described, omitting the Noise Test.

NOTE

The system self-test functions must always be disabled when conducting a performance test without an antenna.

L. Problems

If there were problems with any part of the performance test that could not be resolved, perform the following steps:

1. If a system problem is suspected to be antenna related, the WX-SM Skinmapper antenna may be substituted on the aircraft for testing purposes to confirm a bad antenna. If problems persist, contact the Product Support Department in Columbus, Ohio, U.S.A., or an Authorized Repair Station (ARS) outside the United States, for advice and instructions.

(614) 825-2006
FAX (614) 825-2036

Remember to document any significant problems before contacting the Product Support Department or an ARS.

2. If the problem is suspected to be in the processor, display, or connections and wiring, troubleshoot the entire system (Refer to Section 5.8 TROUBLESHOOTING.)
3. Call the Product Support Department in Columbus, Ohio, U.S.A., (or an ARS) if advice and instruction is needed.
4. If necessary, remove the system from the aircraft and repeat the bench test procedure.
5. After all testing is complete, take appropriate action based on the final results.

This completes the system performance test.

5.8 TROUBLESHOOTING

NOTE

Correct seating of the *Stormscope* processor into the processor tray is vital to proper system operation. FlightSystems recommends checking processor/tray engagement first whenever a *Stormscope* system problem is apparent. (See Installation Sections 2.8.1 and 2.14.)

5.8.1 Troubleshooting Chart

Figure 5-16 lists system problems that may be encountered, along with symptoms that may provide a clue to their causes. Appropriate actions to resolve the problems are also given. When more than one action is shown, they should be taken in the order listed.

All possible problems cannot be anticipated or justified in a chart like this. Its use, however, will help solve many of the more common faults.

Figure 5-16. Troubleshooting Flowchart

PROBLEM	SYMPTOM	CAUSE	ACTION
Display presentation does not appear:	Green LED not lit on processor	Processor is not getting A+, Ground.	<ul style="list-style-type: none"> * Check processor tray seating. * Reset breaker. * Check battery wiring. * Bench test processor-display.
	Green LED lit faintly on processor	Processor is getting A+, Ground, but not PWRSWHI, PWRSWLO	<ul style="list-style-type: none"> * Switch on PWR/Brightness. * Check PWRSWHI, PWRSWLO wiring. * Bench test processor-display.
	Green LED lit on processor	Processor power supply is ON. Problem in display.	<ul style="list-style-type: none"> * Turn Brightness fully CW. * Check display cable. * Bench test processor-display.
	Green and Yellow LED's lit on processor.	Processor power supply overload or fault.	<ul style="list-style-type: none"> * Check display power wiring. * Check antenna power wiring. * Bench test processor-display.
	Green and Red LED's lit on processor.	Processor is ON. Software has detected a fault. Problem is in processor.	<ul style="list-style-type: none"> * Turn Brightness fully CW. * Bench test processor-display.
Presentation is distorted			<ul style="list-style-type: none"> * Check display cable wiring. * Bench test processor-display.
Presentation "vibrates"		Electrical or magnetic interference to display.	<ul style="list-style-type: none"> * Check for interference from aircraft systems*. * Bench test processor-display.

* Pull display out of panel. If problem disappears, it is being caused by another panel unit.

Figure 5-16. Troubleshooting Chart (continued)

PROBLEM	SYMPTOM	CAUSE	ACTION
Improper Brightness control	Focus problem or "Blooming"	Display problem.	* Call factory service.
Improper response to buttons			* Check display button wiring in display cable. * Check processor-tray seating. * Bench test processor-display.
Incorrect information displayed on the "System Data" Screen		Incorrect configuration	* Check options jumpers. * Bench test processor-display.
No response to WX-PA		Box or wiring failure or interference	* Check system wiring, particularly antenna cable. * Check for interference problems. * Bench test processor-display.
Improper Range or Azimuth with WX-PA		Box, wiring, or test setup problem.	* Check WX-PA antenna alignment. * Check WX-PA menu selections. * E-W reversed - check XHI-XLO in antenna cable. * N-S reversed - check YHI-YLO in antenna cable. * Bench test processor-display-antenna. * Make sure self-test disabled. * Check options jumpers. Check for interference problem.** * Check for box or wiring fault.
WX-PA strike points become scattered, delayed, or smeared			*Check for interference problem.**
System plots non-existing storms			* Check for box or wiring fault. *Check for interference problem.**
Improper compass tracking		Incorrect heading.	* Check synchro cable wiring. * Bench test processor-display.

** Use the WX-SM Skinmapper to check for noise source near antenna.

5.8.2 Error Messages

The *Stormscope* Series II system runs a series of detailed self-tests at power-up and on demand through the Options mode of the Main Menu. It also continuously performs a slightly shorter self-test program as long as the system is operating. (The table in figure 3-12 in the Operation Section describes the system self-tests.)

When a self-test identifies an abnormal condition, an error message appears in the system display. The message identifies the fault, and in most cases, how it affects the system. (The fault is identified with a number in systems that have processor software version 2.00 or higher.) Figure 5-17 lists the error messages, what causes them, and what action should be taken.

Figure 5-17. Error Messages

Message		Cause	Action
Software Version 2.00 or Higher	Software Version 1.21 or Lower		
ERROR 01 Continued operation is not possible.	HARDWARE ERROR Continued operation is not possible	Processor fault	•Call Factory Service.
ERROR 03 Time of day and elapsed time are not available.	CLOCK BATTERY DEAD	Real time clock battery dead	•Call Factory Service.
ERROR 10 Heading stabilization is not available. Press any key to continue.	HARDWARE ERROR	Heading processing failure	•Check synchro wiring. •Check heading source. •Check 400 Hz source.
ERROR 11 Heading stabilization is not available. Press any key to continue.	HARDWARE ERROR	Heading processing failure	•Check synchro wiring. •Check heading source. •Check 400 Hz source.
*ERROR 13-15 Navaid option not available Press any key to continue.		Faulty or missing data from Navaid.	•Check Interconnect. •Check "Raw LORAN Data" mode. •Check "LORAN Setup" mode for current model and parameter selections.
*ERROR 16 Expansion board fault. Navaid option not available. Press any key to continue.		Internal communications error	•Call Factory Service.

* Errors 13 through 18 appear only with processor software version 3.00 or higher.

Figure 5-17. Error Messages

Message		Cause	Action
Software Version 2.00 or Higher	Software Version 1.21 or Lower		
*ERROR 18 Expansion board fault. Serial port B Option not available. Press any key to continue.		Internal processor fault	•Call Factory Service.
ERROR 20-25 Continued operation is not possible.	HARDWARE ERROR Continued operation is not possible.	Processor fault	•Call Factory Service.
ERROR 26, 27 Checklist operation is not available. Press any key to continue.	MEMORY ERROR	System memory error	•Call Factory Service.
ERROR 30-36 Continued operation is not possible.	HARDWARE ERROR	Processor fault	•Call Factory Service.
ERROR 40-43 Weather mapping is inhibited. Press any key to continue.		Strike processing test failure.	(See next page)
40		Strike processing test failure.	•Check ANTTSTHI, ANTTSTLO wiring.
41		Strike processing test failure.	•Check XHI, XLO wiring.
42		Strike processing test failure.	•Check YHI, YLO wiring.
43		Strike processing test failure.	•Check EHI, ELO wiring.
ERROR 44 Weather Mapping is inhibited. Press any key to continue.	HARDWARE ERROR Invalid test strikes.	Strike processing test failure.	•Check Antenna mount selection jumper. •Bench test Processor, Display, and Antenna. •Call Factory Service.

* Errors 13 through 18 appear only with processor software version 3.00 or higher.

Figure 5-17. Error Messages (continued)

Message		Cause	Action
Software Version 2.00 or Higher	Software Version 1.21 or Lower		
ERROR 45 Weather Mapping is inhibited.	HARDWARE ERROR No test strikes.	Strike processing failure	•Bench test Processor, Display and Antenna. •Check for electrical interference. (See 5.8.3.)
ERROR 46 Weather Mapping is inhibited. Press any key to continue.	ANTENNA ERROR	Antenna failure	•Check Antenna cable. •Bench test Processor, Display and Antenna.
ERROR 47 Weather Mapping is inhibited.		Strike processing test failure.	•Bench test Processor, Display and Antenna. •Check for electrical interference. (See 5.8.3.)
ERROR 48 Weather Mapping is inhibited. Press any key to continue.		Electrical Noise	•Check for electrical noise (5.8.4.) •Call Factory Service.
MIC KEY STUCK Weather Mapping is inhibited.	MIC KEY STUCK	Inhibit line active over one minute.	•Check mic key. •Verify radios switched on. •Check inhibit wiring. •Bench test Processor, Display and Antenna.
SOFTWARE ERROR Digital Ver. X.XX Analog Ver. X.XX	SOFTWARE ERROR Digital Ver. X.XX Analog Ver. X.XX	Incompatible ROM versions	•Call Factory Service.
SOFTWARE ERROR Digital Model WX-1000X Analog Model WX-1000X	SOFTWARE ERROR Digital Model WX-1000X Analog Model WX-1000X	Incompatible ROM models	•Call Factory Service.

NOTE

The WX-1000/WX-1000+ Systems with 2.00 or higher software will recover from noise-induced system errors if the noise source is removed, or if the intensity decreases below the triggering threshold. This may occur in cases of intermittent noise or in changes in distances from an external noise source (low-frequency transmitting towers, buried cables, etc.). If a noise interferes with the system long enough to cause an error, the WX-1000/WX-1000+ will display an Error 45. Weather mapping is inhibited. When a display button is pressed, a "PLEASE STAND BY" message will appear on the weather screens. This message will remain as long as the interfering noise is present. When the noise is no longer a factor, the message will disappear and the *Stormscope* System will operate normally.

5.8.3 Connector Pin-Outs

The signals found on the pins of *Stormscope* system component connectors are given in the following paragraphs. Refer to figure 2-18, System Interconnect, in the Installation Section for interconnection details.

1. Display Connector (P101)

<u>Pin</u>	<u>Signal</u>	<u>Function</u>
1	N/C	
2	(Jacket)	Sub-cable shield termination
3	N/C	
4	N/C	
5	HSYNCLO	Differential Horizontal Sync pulse
6	HSYNCHI	Differential Horizontal Sync pulse
7	VIDOUTLO	Differential Video signal
8	VIDOUTH	Differential Video signal
9	VSYNCHI	Differential Vertical Sync pulse
10	VSYNCLO	Differential Vertical Sync pulse
11	N/C	
12	SFTKEY2	Lower left Display pushbutton
13	SFTKEY1	Upper left Display pushbutton
14	-15V	-15 volt power supply to Display
15	N/C	
16	N/C	
17	N/C	
18	DSPGND	Display power supply and signal common
19	+15V	+15 volt power supply to Display
20	N/C	
21	Airframe Gnd	Airframe Ground connection
22	PWRSWHI	Display power switch source
23	PWRSWLO	Display power switch return
24	SFTKEY4	Upper right Display pushbutton
25	SFTKEY3	Lower right Display pushbutton

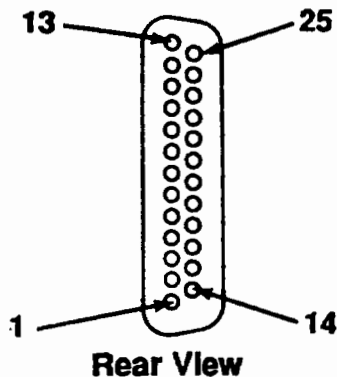
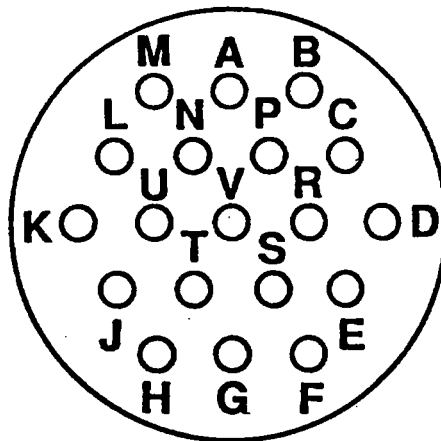


Figure 5-18. Display Plug Pin-Out

2. Antenna Connector (P201)

<u>Pin</u>	<u>Signal</u>	<u>Function</u>
A	ANTGND	Antenna power and signal common
B	ANNTSTHI	Differential test prompt from processor
C	ANNTSTLO	Differential test prompt from Processor
D	+12V	+12 volt power supply to Antenna
E	EHI	Differential sense signal to Processor
F	ELO	Differential sense signal to Processor
G	XHI	Differential X loop signal to Processor
H	XLO	Differential X loop signal to Processor
J	-12V	-12 volt power supply to Antenna
K		(Jacket N/C)
L	YLO	Differential Y loop signal to Processor
M	YHI	Differential Y loop signal to Processor
N	N/C	
P	N/C	
R	N/C	
S	N/C	
T	N/C	
U	N/C	
V	Airframe Gnd	Airframe Ground connection

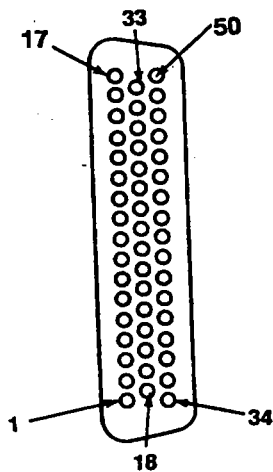


Rear View

Figure 5-19. Antenna Plug Pin-Out

3. Processor Connector (P301)

<u>Pin</u>	<u>Signal</u>	<u>Pin</u>	<u>Signal</u>
1	GROUND	31	N/C
2	GROUND	32	N/C
3	+15V	33	XHI (bottom mount) XLO (top mpunt)
4	N/C	34	A+
5	(Jacket)	35	A+
6	HSYNCHI	36	-15V
7	VSYNCLO	37	N/C
8	X(S1)	38	DSPGND
9	SFTKEY1	39	VIDOUTH1
10	INHIBIT	40	VSYNCHI
11	H(REFINHI)	41	Y(S3)
12	(Jacket)	42	C(REFINLO)
13	(Jacket)	43	SFTKEY3
14	+12V	44	SFTKEY4
16	N/C	45	ANTTSTHI
17	XHI (top mount) XLO (bottom mount)	46	N/C
18	N/C	47	-12V
19	N/C	48	ELO
20	PWRSWLO	49	YHI
21	PWRSWHI	50	YLO
22	VIDOUTLO		
23	HSYNCLO		
24	Z(S2)		
26	SFTKEY2		
27	FLAGHI		
28	FLAGLO		
29	N/C		
30	ANTGND		



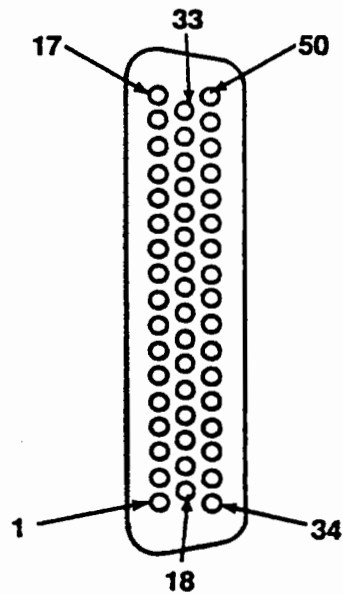
Rear View

Figure 5-20. Processor Plug Pin-Out

4. Communications Connections (P302)

There are no connections at present to any of the pins not listed.

<u>Pin</u>	<u>Signal</u>	<u>Function</u>
3	RS232/RS422 COMM	Navaid option
4	232TX1/422B	
5	232RX1/422A	
18	232TX2	Spare
19	232RX2	RS-232C
20	232GND2	
21	429TXB	
34	429RX1A	ARINC-429
35	429RX1B	Option
38	429TXA	
36	429RX2A	Spare
37	429RX2B	ARINC-429



Rear View

Figure 5-21. Communications Plug Pin-Out

5.8.4 Troubleshooting Electrical Noise

A. The following steps are performed when troubleshooting a problem suspected to be caused by electrical noise.

1. Run an interference test to reproduce the problem on the ground. (See Section 5.7.3H.)

If a problem cannot be reproduced on the ground, schedule a flight test for further troubleshooting.

2. Use a WX-SM Skinmapper to check for interference radiated into the antenna.

The Skinmapper checks for radiated noise only.

3. Isolate the aircraft system that generates the noise.
4. Check potential noise sources close to the system (cables, boxes, components).
5. Repair, replace, or relocate the offending source, or relocate the *Stormscope* antenna, if necessary.

B. Coupling

The noise (interference) source can be isolated in two ways: by switching off one system at a time (preferably at the circuit breaker); or by running a system which cannot be switched off through all its operational modes. When the proper WX-PA response or system self-test response is restored, the offending system has been identified.

Systems that are common noise sources include:

- Alternators or generators
- Autopilot systems (especially trim servos and amplifiers)
- Pulse systems (DME, transponder)
- Strobe lights or beacons
- Air conditioners or heater blowers
- Fluorescent light systems
- Windshield heat

If the noise cannot be isolated to an aircraft system, contact the Product Support Department (or an ARS outside the U.S.) for advice and assistance.

BFG FlightSystems, Inc.
Product Support Department

(614) 825-2006 USA
FAX (614) 825-2036

Electrical noise can be coupled into the WX-1000 or WX-1000+ system by several avenues:

1. Radiation into the Antenna. The Processor can be driven directly by the WX-PA with the antenna removed (Fig 5-15). If this eliminates the symptom, it may be necessary to relocate the antenna.

2. Grounding problems due to poor airframe bonding. All system grounds must conform to Figures 2-18 and 2-19 in the Installation Section. The interference source must be properly grounded. It may be necessary to relocate the WX-1000/WX-1000+ system airframe grounds, or airframe grounds on the interference source.

3. Faulty component interference source. Replacing the suspected interference source will confirm this.

4. Excessive ripple on the A+ line to the Processor. This can be confirmed by powering the processor from an isolated DC power source. It may be necessary to install an in-line filter on the processor, or on the interference source.

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5.9 REPAIRS

If troubleshooting results indicate that repairs are necessary, the faulty equipment must be returned to the Product Support Department in Columbus, Ohio, or to an Authorized Repair Station (ARS) outside the United States, for service. Component-level repairs are performed at the factory in Columbus, Ohio, U.S.A. All repaired equipment will be returned to the dealer for installation and testing.

5.9.1 Stormscope System

Prior to returning a failed system for repair, ensure that the following steps have been taken:

1. Confirm the defect in the aircraft. (See Section 5.7, PERFORMANCE TEST.)
2. Confirm the defect on the bench to eliminate the possibility of an installation related problem. (See Section 5.3, BENCH TEST.)
3. Contact the FlightSystems Product Support Department in Columbus, Ohio (or an ARS), for advice.

(614) 825-2006
FAX (614) 825-2036

4. Return the failed system to the address indicated below (or to an ARS). Include a letter describing the problem, point of contact and telephone number, in the packing with the system to be repaired. This letter is necessary to ensure expeditious repair and proper billing.

BFGoodrich FlightSystems, Inc.
2001 Polaris Parkway
Columbus, Ohio 43240
U.S.A.

Repairs are made on a first in - first out basis. Every effort is made to minimize turn-around time. Incomplete information about the nature of the defect, or customer/warranty status, may delay the repair.

5.9.2 WX-PA Portable Analyzer

The WX-PA repair procedures are exactly the same as those listed in 5.9.1 except that a different complaint form is used.

1. If the WX-PA does not pass its self-tests, or its outputs are incorrect (see the WX-PA Instruction Manual), contact the FlightSystems Product Support Department (or an ARS) for advice.

(614) 825-2006 USA
FAX (614) 825-2036

2. Return the failed system to the address indicated below (or to an ARS). Include a letter describing the problem, point of contact and telephone number, in the packing with the system to be repaired. This letter is necessary to ensure expeditious repair and proper billing.

BFGoodrich FlightSystems, Inc.
2001 Polaris Parkway
Columbus, Ohio 43240
U.S.A.

Repairs are made on a first in - first out basis. Every effort is made to minimize turn-around time. Incomplete information about the nature of the defect, or customer/warranty status, may delay the repair.

5.9.3 Loaner/Exchange Component

In instances where a problem with a *Stormscope* Series II system component results in an AOG (aircraft on ground) situation, and the normal repair turn-around time is unacceptable, a loaner or exchange component may be requested. Subject to availability, the loaner or exchange component will be shipped immediately, provided the following conditions are met:

1. The dealer includes a purchase order for the full price of the component requested with the request.
2. The dealer furnishes the serial number of the defective component.
3. The dealer furnishes the name of the registered owner.

The full price of the loaner component will be billed to the dealer's account until the loaner or the faulty component is received at BFG FlightSystems in Columbus. At this time the account will be credited for the full price of the loaner/exchange component.

5.10 UPGRADES AND OPTIONS

The WX-1000 system can be upgraded to a WX-1000+ system. The WX-1000+ can be upgraded with an Expansion Interface PCB to include an Option. (A model WX-1000+ with an Expansion Interface PCB installed becomes a model WX-1000E.) The three options currently available are identified in paragraph 1.2.2 of this manual. The options are described in the appendices of this manual.

All upgrades and options are installed by the Product Support Department in Columbus, Ohio, USA, or an Authorized Repair Station (ARS) outside the United States.

When an upgrade is ordered, the arrangements for returning the system for upgrade installation are the same as those required if it were being returned for repair. Refer to section 5.9, REPAIRS.

5.11 PRODUCT WARRANTY

5.11.1 Warranty Statement

Important Notice to Purchaser

BFG FlightSystems warrants all *Stormscope* weather mapping systems and components against defects in materials and workmanship for 18 months from date of shipment by BFG FlightSystems to an Authorized *Stormscope* Systems Dealer, or for 12 months from date of original installation by an Authorized *Stormscope* Systems Dealer, whichever occurs first. BFG FlightSystems' obligation, and your exclusive remedy, shall be, at BFG FlightSystems' option, to repair or replace any component proved to be defective during the stated warranty period. This warranty does not apply to any system component which has been (1) repaired or modified by persons unauthorized by BFG FlightSystems so that, in BFG FlightSystems sole judgment, the performance or reliability is adversely affected thereby; or (2) subjected to misuse, neglect, accident, or weather-related damage. THIS WARRANTY IS EXCLUSIVE AND IS MADE IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. BFG FlightSystems shall in no event be liable for any loss or damage, whether direct, indirect, or consequential, arising out of the use, misuse, or inability to use *Stormscope* weather mapping systems or any component thereof. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

BFG FlightSystems reserves the right to make any changes in software, design, or construction of *Stormscope* weather mapping systems or components at any time without incurring any obligation to make any change whatsoever in systems or components previously sold and delivered.

Unless approved in advance, sale of individual *Stormscope* system components is strictly prohibited, except for incorporation into existing *Stormscope* systems or for purposes of replacement. BFG FlightSystems assumes no responsibility whatsoever for use or incorporation of *Stormscope* weather mapping systems or components with other products or equipment.

The foregoing warranty is expressly made conditional upon, and shall apply only if, *Stormscope* weather mapping systems and components are installed and serviced by an Authorized BFG FlightSystems *Stormscope* Dealer.

NOTE

To ensure warranty coverage, the warranty card supplied with the product must be completed and returned to BFG FlightSystems within 15 days of delivery of the installed product by the initial retail owner.

5.11.2 Related Policies and Procedures

1. If the original registered owner of a *Stormscope* system sells the aircraft in which the system is installed during the warranty period, the remaining warranty may be transferred. Written notification of the transaction must be submitted by the initial recipient of the warranty to:

ATTENTION: WARRANTY ADMINISTRATOR
BFGoodrich FlightSystems, Inc.
2001 Polaris Parkway
Columbus, Ohio 43240
U.S.A.

2. Equipment must be installed by an authorized dealer or installer. Installation of equipment by facilities not specifically authorized will void the equipment warranty.
3. Notice of a claimed product defect must be given to BFG FlightSystems or a designated Service Agency within the specified warranty period.
4. A product which is defective in workmanship and/or material shall be returned to BFG FlightSystems via any Authorized Dealer with transportation charges prepaid. After correction of such defects, the equipment will be returned to the Dealer, transportation prepaid, by BFG FlightSystems via surface transportation. Any other means of transportation must be paid by the customer.

The risk of loss or damage to all products in transit shall be assumed by the party initiating the transportation of such products. All items repaired or replaced hereunder shall be warranted for the unexpired portion of the original warranty, or 90 days, whichever is longer.

5. BFG FlightSystems is in no way obligated or responsible for supporting or participating in the costs of the installation warranty. The entire responsibility lies with the Authorized Dealer making the installation. BFG FlightSystems is only responsible for the product warranties outlined in Section 5.11.1.
6. The *Stormscope* weather mapping systems are susceptible to excessive electrical noise generated within the aircraft, and can be affected by worn brushes on motors, generators and servos; improperly grounded strobes and DME's; and other excessively noisy equipment on the aircraft, even if all installation precautions are observed. BFG FlightSystems cannot authorize warranty credit for troubleshooting other systems in the aircraft in order to reduce noise interference with BFG FlightSystems equipment.

CHAPTER 6

ILLUSTRATED PARTS BREAKDOWN

6.1 Stormscope SYSTEM

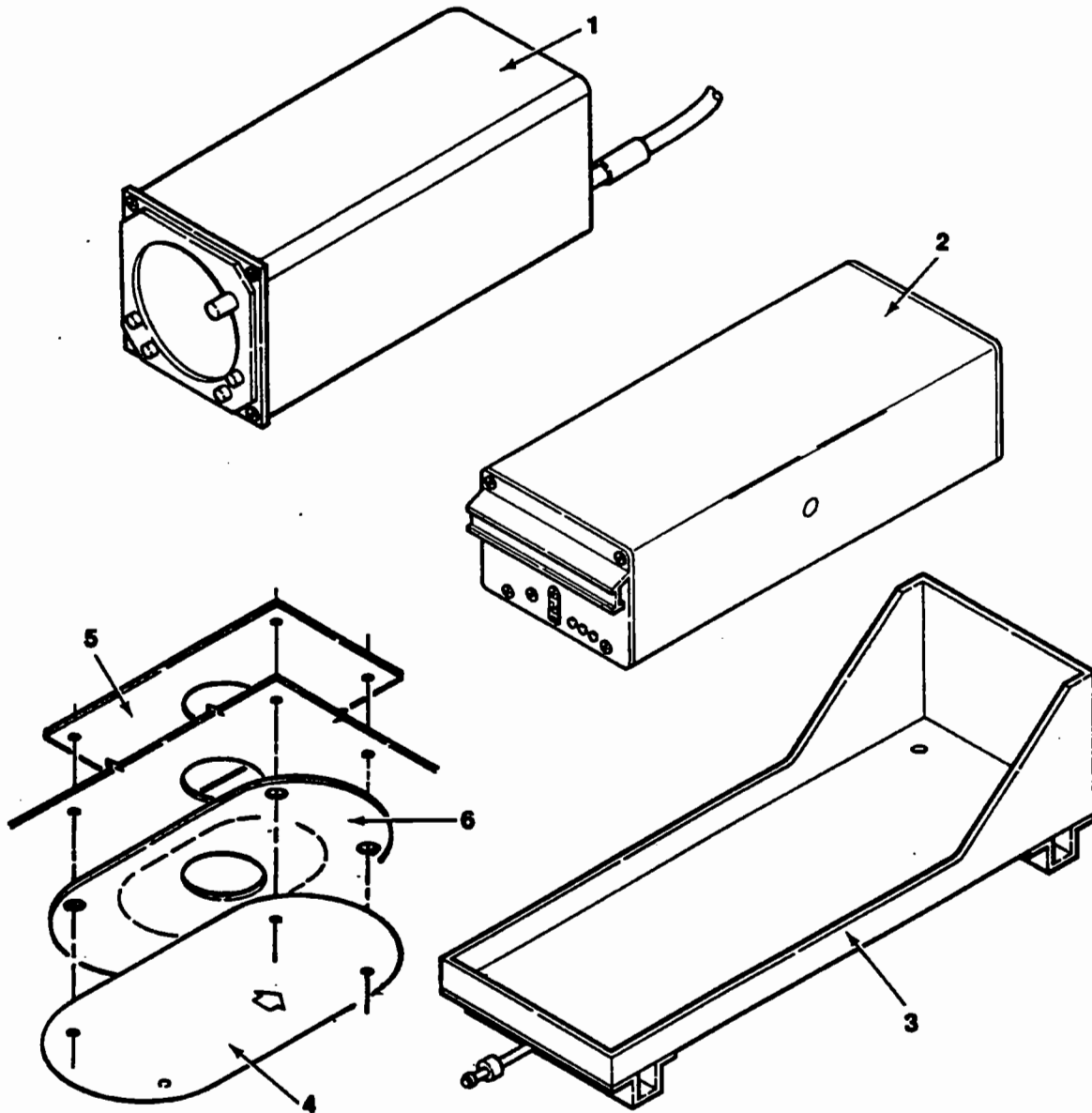


Figure 6-1. Stormscope System

STORMSCOPE SYSTEM (Refer to Figure 6-1)Supplied by BFG FlightSystems with a *Stormscope* Series II system:**A. Model WX-1000 system P/N 78-8060-5780-4 consisting of:**

<u>ITEM</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	78-8060-5900-8	DISPLAY ASSEMBLY	1
2	78-8060-5790-3	PROCESSOR ASSEMBLY	1
3	78-8051-9180-2	PROCESSOR TRAY ASSEMBLY	1
4	78-8051-9200-8	ANTENNA	1
5	78-8051-9206-5	DOUBLER PLATE, Antenna	1
6	78-8051-9208-1	GASKET, Antenna	1
7	78-8060-5755-6	HARDWARE PACKAGE includes all connectors and mounting hardware; (See Figure 6-2)	1
8	78-8060-5793-7	OWNER'S MANUAL PACKET (not shown)	1

B. Model WX-1000+ system P/N 78-8051-9240-4 consisting of:

<u>ITEM</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	78-8060-5900-8	DISPLAY ASSEMBLY	1
2	78-8051-9160-4	PROCESSOR ASSEMBLY	1
3	78-8051-9180-2	PROCESSOR TRAY ASSEMBLY	1
4	78-8051-9200-8	ANTENNA	1
5	78-8051-9206-5	DOUBLER PLATE, Antenna	1
6	78-8051-9208-1	GASKET, Antenna	1
7	78-8060-5755-6	HARDWARE PACKAGE includes all connectors and mounting hardware; (See Figure 6-2)	1
8	78-8060-5793-7	OWNER'S MANUAL PACKET (not shown)	1

6.2 HARDWARE PACKAGE

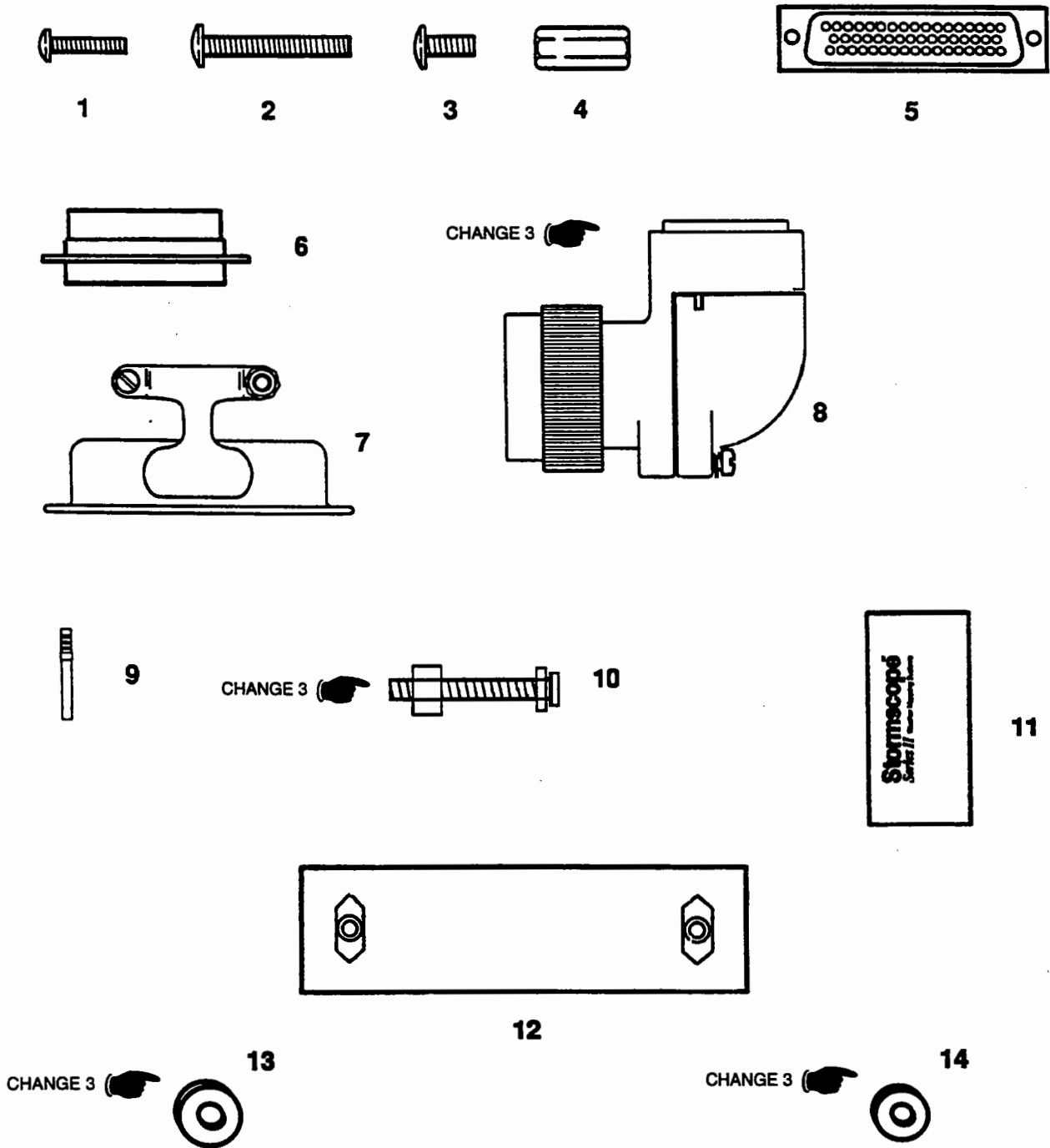


Figure 6-2. Hardware Package

HARDWARE PACKAGE

<u>ITEM</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	26-1001-6374-5	SCREW, Machine 6-32 X 3/4 in. Phillips Pan Head, Black Oxide	4
2	26-1004-9152-6	SCREW, Machine 10-32 X 1-1/2 in. Phillips Pan Head, Stainless Steel	4
3	77-8001-2640-9	SCREW, Machine 10-32 X 1/2 in. Phillips Pan Head, Stainless Steel	4
4	26-1006-2424-1	STANDOFF, 3/16 Hex X 1/2 in. 4-40 Thd. Alum.	4
5	26-1006-1098-4	CONNECTOR, 50 POS. D-Sub Recept. Shell	2
6	26-1003-5633-1	CONNECTOR, 25 Position Recept. Shell	1
7	26-1006-2426-6	CONNECTOR BACKSHELL, DB25	1
8	26-1006-2425-8	CONNECTOR, 19 Position, Round Recept. with/Contact and Shell	1
9	26-1003-4724-9	CONNECTOR SOCKET, Screw Mach. (M39029/63-368)	100
10	26-1006-1089-3	CONNECTOR LOCK POST ASSEMBLY	2
11	78-8060-5733-3	LABEL, Circuit Breaker Identification	1
12	78-8051-9187-7	NUT PLATE ASSEMBLY, Processor	2
13	26-1006-5217-6	WASHER, Aluminum, .204 x .631, .063 Thick	12
14	26-1006-5218-4	WASHER, Mylar, .182 x .376, .007 Thick	4

APPENDIX A

Stormscope[®] Series II/Loran Interface

A. Introduction

NOTE

All references to Loran in relation to the Navaid Option in this manual also apply to qualified GPS units. When "Loran" is mentioned, it can be considered "Loran/GPS". This will gain greater significance as more GPS receivers are qualified.

NOTE

Stormscope Model WX-1000+ becomes a Model WX-1000E with the addition of an Expansion Interface PCB (expansion board) to the processor. All three *Stormscope* Options require an expansion board. All references to Model WX-1000E in this Appendix pertain only to *Stormscope* Model WX-1000+ with the Navaid Option installed.

The WX-1000/WX1000+ *Stormscope* weather mapping system, with the Navaid Option installed, can display simultaneous navigational information with real-time thunderstorm information. In order to accomplish this, a BFG FlightSystems qualified Loran receiver must be installed in the aircraft.

The Loran receiver provides inputs to the *Stormscope* processor. The processor must be using the correct communications interface protocol (RS-232C or RS-422) and parameters in order to use the inputs. This appendix provides protocol and parameter details for qualified Loran receivers.

B. Loran Communications Setup

The WX-1000+ Navaid system will accept a wide variety of Loran communication formats. Generally, the default settings for a particular Loran will be sufficient to drive the Navaid system. There are a few exceptions, however, and these are listed below. (There is also a brief description on setting the Loran parameters to the required values.)

ARNAV R-40

The ARNAV R-40 allows programming of a number of communication parameters. This programming is performed in the R-40 setup mode, reached by the following sequence:

1. Press NAV on the R-40 control panel.
2. Switch the selector to the DIS/TIM display.
3. Hold the ENT button until the display changes to:

Std	SOUT
U 45	C 30
PW	40 *

4. Each of these items can be modified by pressing **ENT** and entering new data by using the keyboard (for numbers), pressing the **ARROW** key, or by rotating the function switch.

The Navaid system requires that the communications format be set as follows:

<u>Item</u>	<u>Description</u>	<u>Setting</u>
Std	Standard/Test Output	Set to Std
U	Data Output Rate	Set to 1
C	Baud Rate/10	Can be 30 to 960 (960 is best)
PW	Page Width	Set to 0

ARNAV-R15, R-30, R-50

These ARNAV Lorans also allow programming of the communication parameters. This programming is performed in the Setup mode for these Lorans reached by the following sequence:

1. Press CLR, and while holding it depressed, press the MDE (mode) key.
2. Switch the selector knob to sequence through the pages, until the display reads either "ELS and FC COMM" or "RS-232 SERIAL OUTPUT".
3. If the display reads "ELS and FC COMM", press ENT to flash the first line, then press the select knob to change to "RS-232 SERIAL OUTPUT".
4. Press ENT to select the RS-232 setup mode.
5. Adjust the parameters as listed below: (press ENT to flash a field, enter data using the normal data entry method, then press ENT again to select data.)

The Navaid system requires that the communications format be set as follows:

<u>Item</u>	<u>Description</u>	<u>Setting</u>
MDE	Standard/Test Output	Set to STD
INT	Data Output Rate	Set to 1
BAUD	Baud Rate/10	Can be 30 to 960 (960 is best)
FORMAT	Page Width	Set to 0

ARNAV R-50i

Software version 5500C is used for the R-50i. Original R-50i software - does not provide waypoint identifier.

ARNAV R-50V, R-5000

Magnetic Variation (MVAR) not available in some versions.

Requires LORAN setup as follows:

Select AUX MODE, turn to SELECT SETUP MODE PAGES, turn to RS-232, set to:
RS-232 PORT 1: SHORT
Deg: MAG XTK: NORMAL
Check Sum: Enable (if available)
EDI Output: Enable (if available)
EDI Update Rate: 3 to 8 (if available)

ARNAV FMS 5000

Requires LORAN setup as follows:

Select AUX MODE, turn to SELECT SETUP MODE PAGES, turn to RS-232, set to:
RS-232 PORT 1: SHORT
Deg: MAG XTK: NORMAL
Check Sum: Enable (if available)
EDI Output: Enable (if available)
EDI Update Rate: 3 to 8 (if available)

ARNAV STAR 5000

Requires GPS setup as follows:

Select AUX MODE, turn to SELECT SETUP MODE PAGES, turn to RS-232, set to:
RS-232 PORT 1: SHORT
Deg: MAG XTK: NORMAL
Check Sum: Enable (if available)
EDI Output: Enable (if available)
EDI Update Rate: 3 to 8 (if available)

C. Communications Interface

The Navaid communications interface receives standard RS-232C or RS-422 data. The processor circuitry is set up to accept inputs of one or the other with a DIP switch located on the Navaid Expansion Interface PCB.

1. Check the Interface selected by the DIP switch by entering the Service Menu and selecting Expansion Data. (The Service menu is entered by holding display buttons 1 and 2 depressed while switching the *Stormscope* system on.)

The Loran and the interface that are currently selected will be displayed.

2. Change the indicated Loran by selecting LORAN Setup from the Service Menu, and then designating the desired Loran. (See Operation Section 3.5.7.)
3. Change the indicated interface (RS-232C or RS-422) by changing the DIP switch selection on the Expansion Interface PCB, (See Maintenance Section 5.5.)

D. Communications Parameters

The communications parameters of the system processor must match the parameters of the interfaced Loran receiver. The parameters are baud rate, parity, data bits, and stop bits.

The communication parameters of some Loran receivers cannot be changed by the operator. In this case the values are automatically set when the Loran is selected on the LORAN Setup screen. No further action by the operator is necessary.

The communication parameters of other Loran receivers can be changed by the operator. When one of these Lorans is selected on the LORAN Setup screen, the LORAN Parameters screen will appear.

This screen shows the default values of the parameters that are automatically set when the Loran is selected.

1. Check the communications parameters of the interfaced Loran. (Consult the documentation for the specific Loran for the procedure to do this.)
2. Change the processor parameters as necessary to match those of the Loran receiver.

The default values will be the ones used unless they have been modified to connect to a fuel computer or some other system. (See Operation Section 3.5.7.)

E. Pin-Outs of Qualified RNAV Systems

The following table lists the communications interface, navigational items available for display, and the wiring interconnect details for all the Loran sets qualified for use with the *Stormscope* Series II System Navaid Option. The table will be revised as the number of qualified Lorans increases.

The inputs to the system processor from the Loran receiver are always on pins 3, 4, and 5 of plug 302. The connections at the Loran vary from model to model. Refer to the table on the following page for details.

CAUTION

Information provided in the Qualified Loran Pin-Out Table (see Figure A-1) is believed to be complete and accurate at the time of publishing. BFGoodrich FlightSystems has no control over product or software changes made by other manufacturers. It is the responsibility of the installer to confirm compatibility.

Equipment	Communications Interface	Navigation Items (Paragraph F)	Interconnect Wiring					These notes pertain to the assemblies identified in the Equipment column.
			WX-1000+ Signal					
			Plug	232TX /422B	232RX /422A	232 COMM 422 COMM		
			P302	PIN 4	PIN 5	PIN 3		
Apollo 604, 611 612, 612A, 612B, 618, 618T	RS-232C	D	P1	N/C	6	8		
Apollo 800, 819, 820	RS-232C	A	P1	N/C	6	8	Apollo 800 - Software versions 1.13 and above. (Select 800 on LORAN setup for 819 and 820)	
Apollo 612C, 618C	RS-232C	D	P1	N/C	12	14		
Apollo 614R, 618R	RS-232C	D	P1	N/C	BNC Connector			
Apollo NMC2001	RS-232C	A	P1	N/C	Port 1: Pin 19 Port 2: Pin 37	20	Must be software configured for the appropriate output port.	
ARNAV R-15, R-25, R-30	RS-232C	E	P1	N/C	3	13		
ARNAV R-21	RS-232C	E	P1	N/C	3	13	Jumper P1, pins 16-17-1.	
ARNAV R-40	RS-232C	C	P1	N/C	3	13	Version 4.06 Only Jumper P1, pins 16-17.	
ARNAV RDB	RS-232C	C	J2	N/C	8	9	Special Software Required	
ARNAV R-50	RS-232C	E	P1	N/C	3	13	All except R-50i	
ARNAV R-50i	RS-232C	F	P1	N/C	3	13	See para B for setup.	
ARNAV R-5000, STAR 5000, FMS 5000	RS-232C	F/B	P1	N/C	3	13	See paragraph B for setup. (Select R-5000 on WX-1000E LORAN setup for all three)	
ARNAV R-60	RS-232C	E	P2	N/C	B	V	Jumper P2, pins A-G. Select R-40.	
BFG FlightSystems F4, LRN500	RS-232C	C	P5001	N/C	1	2	Requires version 1.1 of RS-232 software.	
BFG FlightSystems F14, LRN501	RS-232C	C	P5001	N/C	1	2	Requires version 1.3 of RS-232 software.	
BFG FlightSystems LNS616A/B	RS-232C	C	P2	N/C	4	11		
BFG FlightSystems LNS6000	RS-232C	A	J4	N/C	25	27		
GARMIN GPS100	RS-232C	A	J100	N/C	13	15		
GARMIN GPS150	RS-232C	A	J101	N/C	24	26		
GARMIN GPS155	RS-232C	A	J101	N/C	24	26		
King KLN-88	RS-232C	A	P881	N/C	13	35		
King KLN-90/90A	RS-232C	A	P901	N/C	13	Ground Lug	Select KLN-88 on WX-1000E set-up.	

Figure A-1. Qualified Loran Pin-Out Table

Equipment	Communi- cations Interface	Navigation Items (Para- graph F)	Interconnect Wiring				These notes pertain to the assemblies identified in the Equipment column.
			WX-1000+ Signal				
			Plug	232TX /422B	232RX /422A	232 COMM 422 COMM	
			P302	PIN 4	PIN 5	PIN 3	
Magellan SKYNAV-5000	RS-232	A			12	7	232RX/422A Use pin 12 (port 1) or pin 25 (port 2). Select GARMIN GPS/100 or King KLN- 88 set-up.
Northstar GPS-600	RS-422	A	P1	6	11	23	
Northstar M1,M2	RS-422	A	P1	6	11	23	Software version 2.03 required for flight plan display.(Select M1 for M1 and M2 on LORAN setup)
Trimble TNL-2000,3000	RS-422	B	P1	3	15	18	Select format K0 (1 Per Second).
Trimble TNL-2100,3100	RS-422	B	P1	37	5	1	Select format K0 (1 Per Second).

Figure A-1. Qualified Loran Pin-Out Table (Continued)

F. Navigational Display Items

The inputs from the Loran receiver are processed so navigational data can be displayed on the *Stormscope* weather screens. Not all Loran units provide the same data, however.

The navigational information available when interfaced to specific models of Loran receivers is indicated by a letter in the Qualified Loran Pin-Out Table on the preceding page of this appendix. The letters correspond to the following groups of items.

1. A Active Waypoint Identifier
 Course Line and Waypoint
 Range and Bearing to Active Waypoint
 Current Track
 Cross Track Error
 Course Deviation Indicator
 Ground Speed
 Estimated Time Enroute
 Estimated Time of Arrival
 Magnetic Variation at Present Position
 Digital Stopwatch/Timer
 Current Latitude and Longitude
 Flight Plan Course Lines and Waypoints (up to 10).

2. B Active Waypoint Identifier
 Course Line and Waypoint
 Range and Bearing to Active Waypoint
 Current Track
 Cross Track Error
 Course Deviation Indicator
 Ground Speed
 Estimated Time Enroute
 Estimate Time of Arrival

Magnetic Variation at Present Position
Digital Stopwatch/Timer
Current Latitude and Longitude
Minimum Safe Altitude
Minimum Enroute Safe Altitude
Flight Plan Course Lines and Waypoints (up to 10).

The list of B is the same as that for A , with the addition of minimum safe altitude to the next waypoint, and minimum safe altitude enroute to the programmed destination.

3. C Active Waypoint Number
 Course Line and Waypoint
 Range and Bearing to Active Waypoint
 Current Track
 Cross Track Error
 Course Deviation Indicator
 Ground Speed
 Estimated Time Enroute
 Estimated Time of Arrival
 Magnetic Variation at Present Position
 Digital Stopwatch/Timer
 Current Latitude and Longitude

The list for C is the same as that for A , except that a sequential waypoint number is provided instead of an alpha-numeric waypoint identifier, and there is no flight plan information.

4. D Course Line and Waypoint
 Range and Bearing to Active Waypoint
 Current Track
 Cross Track Error
 Course Deviation Indicator
 Ground Speed
 Estimated Time Enroute
 Estimated Time of Arrival
 Digital Stopwatch/Timer
 Current Latitude and Longitude

The list for D is the same as that for A except that there is no waypoint identification, magnetic variation, or flight plan information.

5. E Active Waypoint Identifier
 Course Line and Waypoint
 Range and Bearing to Active Waypoint
 Current Track
 Cross Track Error
 Course Deviation Indicator
 Ground Speed
 Estimated Time Enroute
 Estimated Time of Arrival
 Magnetic Variation at Present Position
 Digital Stopwatch Timer
 Current Latitude and Longitude
 Minimum Safe Altitude
 Minimum Enroute Safe Altitude

The list for E is the same as that for A with the addition of minimum safe altitude to the next waypoint and minimum safe altitude enroute to the programmed destination, and the deletion of flight plan information.

6. F Active Waypoint Identifier
Courseline and Waypoint
Range and Bearing to Active Waypoint
Current Track
Cross Track Error
Course Deviation Indicator
Ground Speed
Estimated Time Enroute
Estimated Time of Arrival
Magnetic Variation at Present Position
Digital Stopwatch Timer
Current Latitude and Longitude

The list for F is the same as that for A except that there is no flight plan information.

G. Parts List

The following parts are supplied by BFGoodrich FlightSystems with a Model WX-1000E *Stormscope* Series II system (WX-1000+ with Navaid Option), P/N 78-8060-5940-4:

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>QTY</u>
78-8060-5941-2	PROCESSOR ASSEMBLY, including: 78-8060-5894-3 Expansion Interface PCB, Navaid Option - installed in the processor	1
78-8060-5900-8	DISPLAY ASSEMBLY	1
78-8051-9180-2	PROCESSOR TRAY ASSEMBLY	1
78-8051-9200-8	ANTENNA	1
78-8051-9206-5	DOUBLER PLATE, Antenna	1
78-8051-9208-1	GASKET, Antenna	1
78-8060-5755-6	HARDWARE PACKAGE, including all connectors and mounting hardware.	1
78-8060-5793-7	OWNER'S MANUAL PACKET	1

APPENDIX B

Stormscope[®] Series II/ARINC-429 EFIS Option

A. Introduction

NOTE

Stormscope Model WX-1000+ becomes a Model WX-1000E with the addition of an Expansion Interface PCB (expansion board) to the processor. All three *Stormscope* Options require an expansion board. All references to Model WX-1000E in this Appendix pertain only to *Stormscope* Model WX-1000+ with the ARINC-429 EFIS Option installed.

The WX-1000+ *Stormscope* weather mapping system, with the ARINC-429 EFIS Option installed, has the capability to transmit the location of thunderstorm cells to EFIS display systems that are equipped to receive it. The WX-1000 display can be employed with this option or the EFIS display can be the sole source for *Stormscope* data presentation. The ARINC-429 Option also enables the *Stormscope* system to receive heading stabilization data from an ARINC-429 source if desired.

B. Description

The WX-1000E processor transmits thunderstorm information to the EFIS display system via an ARINC-429 serial data link. Thunderstorm data is transmitted continuously in the 200 nm range and the 360 degree view to the EFIS processor and updated every two seconds. The system receiving this data must contain the hardware and software necessary to process it for display. The WX-1000 display does not control the data that is output to the EFIS display system; any control must be accomplished within the EFIS utilizing the *Stormscope* transmission. Thunderstorm data is typically displayed with other navigation and radar data generated by the symbol generator in an overlay fashion.

The locations of up to 63 areas of electrical activity are transmitted by the WX-1000E. These areas are cells of electrical discharges and not individual discharges as provided by the WX-1000 display. The intensity level of the cells is also transmitted. Intensity is identified in three levels, 1 through 3, with level 1 representing the lowest rate of electrical discharge and level three the highest rate. Refer to the appropriate EFIS manufacturers manual for lightning display symbology.

A twisted wire pair (429TXA/429TXB) provides the connection for the serial data link between the WX-1000E system and the EFIS. The speed of the ARINC-429 transmission is selectable as low (12.5 kHz) or high (100 kHz) by setting switches on the expansion board. In the factory preset condition the transmitter is set low.

The WX-1000+ receives heading stabilization data in analog synchro form in order to rotate the thunderstorm presentation during aircraft turns. With the ARINC-429 Option, the *Stormscope* system can also receive heading data from an EFIS that transmits standard ARINC-429 heading labels (320 magnetic and/or 314 true). This feature can be utilized if an analog synchro source is not available or desired. A twisted wire pair (429RX1A/429RX1B) provides the connection required for this serial data link. The operating speed of the ARINC-429 receiver is selectable as low (12.5 kHz) or high (100 kHz) by setting switches on the expansion board. In the factory preset condition the receiver is set low.

If the WX-1000 display is not employed, the normal *Stormscope* Power On/Off and Clear control features are not available to the user. The WX-1000E system can be configured to disregard these controls, or they can be installed external to the system in a convenient location. To implement the Clear feature a momentary pushbutton switch must be installed. To implement the Power control a two-position switch must be installed. If the Power On/Off control is not desired the *Stormscope* system can be jumpered to power-up whenever the source power (avionics bus) is turned on. Although installing these two external control features is not mandatory on systems that do not use a WX-1000 display, they are strongly recommended to improve system control.

C. Compatible EFIS Display Systems

The following systems are compatible for use with the WX-1000E system:

- Bendix/King EFS 40/50
- Eventide Argus 5000/7000 with WDA 5007-05/7007-05 Adapter

Please refer to the appropriate manufacturers installation manuals for configuration and set-up information when interfacing a WX-1000E with one of these systems.

D. Installation

Section 2 of this manual (Installation) shall be followed when installing the WX-1000E *Stormscope* system. The information presented in this section is to be used as a supplement and referenced only for items unique to the ARINC-429 EFIS Option.

Cable lengths must be determined for the ARINC-429 twisted pair used to transmit the *Stormscope* data to the EFIS for display. In addition, cable lengths must be determined for the ARINC-429 heading input, if applicable. All cable and wire runs should be as short as practicable in order to minimize potential electrical interference. If the Clear and Power On/Off features are implemented, the locations of the applicable switches must be determined as well as wire lengths.

The ARINC-429 data cables are #22 AWG twisted, shielded cables. Cable 22TG2T14 (or equivalent) is suggested. When installing the optional switches for the Clear and Power On/Off features the same type cables should be used. The table provided in figure 2-12 lists some U.S. vendors who sell the required cable by the foot. The ARINC-429 cables should be routed by referring to paragraph 2.11.6. Install the ARINC-429 cables referring to paragraph 2-12.

Option jumpers are installed on Processor Auxiliary Connectors P301 and P302 to enable the following option selections:

OPTIONS	PINS TO BE JUMPERED
Install WX-1000E system without WX-1000 display	P302 pins 28 and 45
No On/Off switch used and WX-1000 display is not installed.	P301 pins 20 and 21

If the WX-1000 display is not used and the Clear option is implemented, install a normally-open, momentary pushbutton switch. The switch connects between pins 26 and 38 on processor connector P301. (Also connect a jumper between P302 pins 28 and 45). If the Power On/Off feature is to be implemented, install a two-position switch. This switch connects between pins 20 and 21 on processor connector P301. If the WX-1000 display is not installed, and the Power On/Off feature is not selected, the control must be disabled as described in the table above. Refer to System Interconnect, figure 2-19, as an aid in installation.

E. Operation

The primary purpose of the WX-1000E *Stormscope* system is to alert the flight crew to the presence of thunderstorm activity. The object is to provide a means for the pilot to make thunderstorm avoidance decisions. The system detects lightning data 360 degrees around the aircraft to a distance of 200 nautical miles. The data is provided to the EFIS processor in this range and view continuously and is updated every 2 seconds. The displayed range and view can be manipulated by the user by utilizing the controls and capabilities of the EFIS display system. Refer to the appropriate EFIS manufacturers manual for the operational capabilities of the EFIS display.

The WX-1000E processor transmits system fault status to the EFIS. The WX-1000+ system displays fault codes solely on the WX-1000 display. It is the responsibility of the EFIS display system being employed to display fault status when a WX-1000 display is not installed. The WX-1000E processor logs all system faults in non-volatile memory as with the other WX-1000 series processors.

The SYSTEM DATA display can be accessed to verify the heading source for the *Stormscope* system. A WX-1000 display is required to access this display via the SERVICE MENU. Refer to paragraph 3.5.1 to access the SYSTEM DATA display. The display presented when the ARINC-429 Option is employed is shown in figure B-1. The entry "Heading Source" will identify an analog synchro source (XYZ) or an ARINC-429 source (429) for heading data. If gyro jumper is connected (P302 pins 26 to 43), XYZ heading source is assumed. If jumper is not present, ARINC-429 heading is assumed.

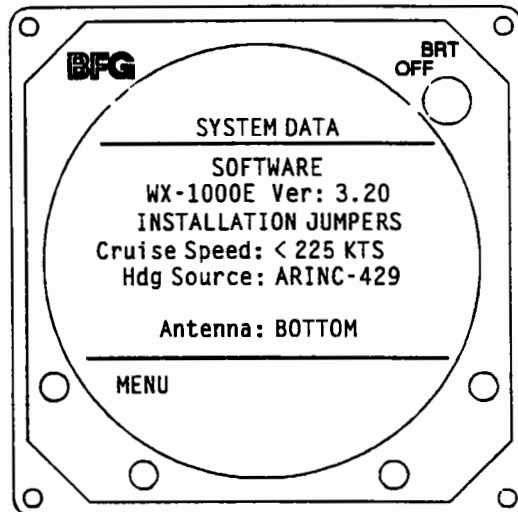


Figure B-1. System Data Presentation (ARINC-429 Heading Source)

F. Maintenance

Expansion Tests Mode

The ARINC-429 interface circuitry can be tested from the Expansion Tests Mode. A WX-1000 display is required to execute the expansion tests (via the display buttons contained on the display bezel). The ARINC-429 test uses the same test and test procedure provided for the Navaid Option in paragraph 3.5.6. Refer to paragraph 3.5.6 to test the ARINC-429 interface portion of the WX-1000E processor. Expansion Tests - Screen 2 is different for the ARINC-429 test and is shown in figure B-2.

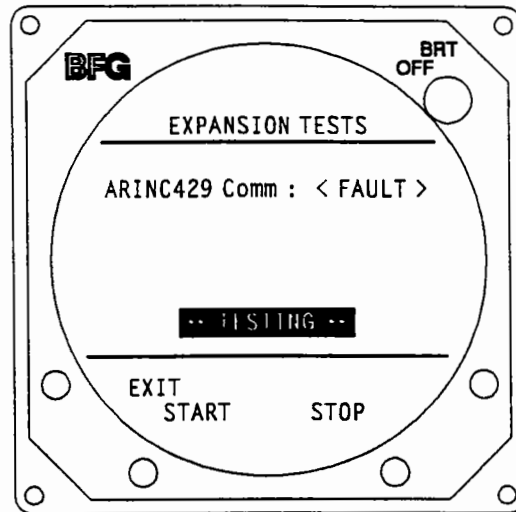


Figure B-2. Expansion Tests - Screen 2 (ARINC-429 Option Installed)

Expansion Board Testing

The bench setup is the same as that outlined in Section 5.3.3, except that the WX-PA does not have to be connected. If it is already connected, it can be switched off. A WX-1000 display is required for bench testing. The WX-1000 display provides the necessary display buttons and the capability to display the processor fault log.

NOTE

When performing this test, the ARINC-429 transmit and receive speed must be the same (both high or low speed). Refer to figure B-4.

1. Enter the Service Mode by powering up the *Stormscope* system while holding display buttons 1 and 2 depressed.
2. Press NEXT until the highlight bar on the Service Menu is on Expansion Tests then press SELECT.
3. The Expansion Tests mode will display the prompt:

**ATTACH EXP TEST PLUG
TO BENCH TEST POD P302**

Press TEST to continue

4. Connect the communications test plug (BF Goodrich Flight Systems P/N 78-8060-5925-5) to the bench test pod connector marked N/C in figures 5-3 and 5-6. (This is connector P302).

The communications test plug consists of a 25 pin D connector attached to a small printed circuit board (represented by figure 5-7). There is an RS-232C/RS-422 switch on the board that can be disregarded during ARINC-429 testing.

5. Press TEST, then press START.

The system will begin testing the ARINC-429 interface circuitry once each second. "TESTING" will appear in the center of the display and the results of the last test will be shown as:

ARINC-429 Comm:<OK>
or
ARINC-429 Comm:<FAULT>

The FAULT message indicates a malfunction in the ARINC-429 circuitry.

6. Press STOP to discontinue the testing.

If the ARINC-429 comm test was <OK>, no further checks are required. The expansion board test is complete.

Fault Isolation

If a fault is indicated on the EFIS display, yet the *Stormscope* system passes the expansion tests portion of bench testing, then the EFIS display system or connecting wires may be faulty. Refer to the appropriate EFIS manufacturers manual for fault indicator definitions.

Adjustments

The ARINC-429 transmitter speed can be set to low speed (12.5 kHz) or high speed (100 kHz) via a DIP switch on the expansion board. In addition, the ARINC-429 receiver speed for heading input can be selected between the same high and low speeds if this feature is utilized. In the factory preset condition the transmitter and receiver speeds are set low. Perform the following procedure to change the DIP switch setting:

1. Remove the expansion board from the WX-1000E processor per paragraph 5.5-A.
2. Position the DIP switches shown in figure B-3 to the appropriate positions to select ARINC-429 transmitter and receiver operating speeds. Refer to the table provided in figure B-4 when setting the DIP switches.
3. Reinstall the expansion board into the WX-1000E processor per paragraph 5-5.A.

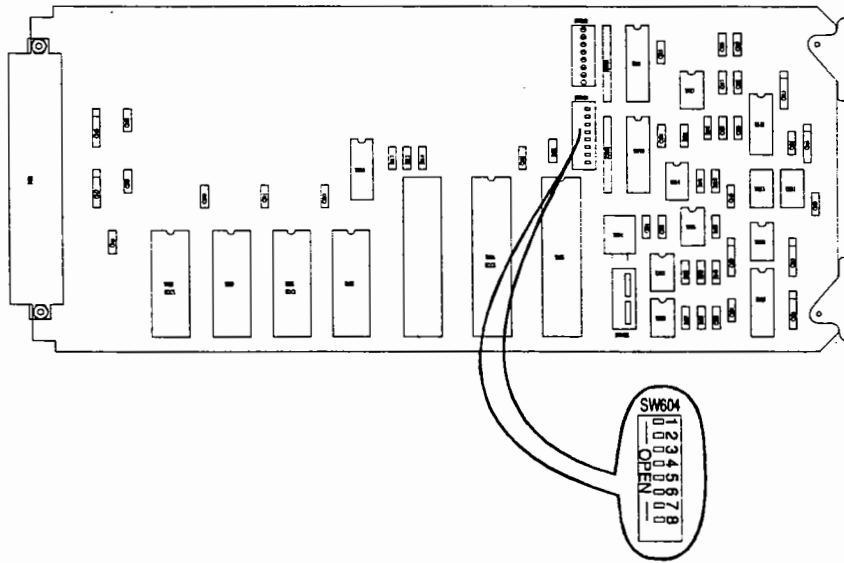


Figure B-3. Expansion Interface PCB (ARINC-429 Adjustments)

ARINC-429 Data Speed	DIP Switches - SW 604							
	1	2	3	4	5	6	7	8
Transmit - high speed	0	0	X	X	X	X	0	X
Transmit - low speed	1	1	X	X	X	X	1	X
Receive - high speed	X	X	X	X	X	X	X	0
Receive - low speed	X	X	X	X	X	X	X	1

0 = Open (Off), 1 = Closed (On), X = Switch position does not matter.

Figure B-4. ARINC-429 DIP Switch Positions

Performance Testing

The performance test procedures of paragraph 5.7.3 should be performed. If a WX-1000 display has not been installed, the display buttons used to initiate some of the testing will not be available. When procedures call for verification of strike presentations on the display, the EFIS display should be checked in addition to the WX-1000 display (if installed). There will be a delay of up to 15 seconds for data presentation on the EFIS display as compared to the WX-1000 display.

Troubleshooting

Troubleshooting procedures will vary based on the system configuration. These configurations and the suggested course of action for troubleshooting are listed below:

Both WX-1000 display and an EFIS display are installed.

1. Verify that the WX-1000 display is operating properly as described in paragraph 5.7.3. If WX-1000 display is not operating properly, troubleshoot as you would for a WX-1000+ system.
2. Execute Bench Testing as specified in section E of this appendix. If the WX-1000 display is functioning properly and the expansion test passes, troubleshoot the EFIS display system and the interconnecting cables.

EFIS display is sole *Stormscope* display.

1. Perform Bench Testing as specified in section E of this appendix. Note that a WX-1000 display is required for this testing.
2. If the *Stormscope* system fails the bench test, troubleshoot the *Stormscope* system per Section 5. If the *Stormscope* system passes bench testing, troubleshoot the EFIS display system and the interconnecting cables.

ARINC-429 Bus Analyzer.

The following ARINC-429 labels are transmitted from the WX-1000E every 2 seconds after the completion of power-on/self-test. Labels 001, 300 and 371: should always be present. Labels 100 through 176: one or more present when cell data being transmitted. WX-1000E system fault status is contained in label 001 data. Data bits within label 001 are set high to indicate system status as identified in figure B-5.

ARINC-429 (Label 001) status bits	Fault Description
bit 18 - set high	Heading flag or no heading data
bit 19 - set high	Mic key asserted - system inhibited
bit 21 - set high	Antenna fault
bit 22 - set high	Processor fault - recoverable (includes error codes 40-48 in figure 5-17)
bit 23 - set high	Processor fault - non-recoverable

Figure B-5. ARINC-429 Status Bits

G. Parts List

The following parts are supplied by BFGoodrich FlightSystems with a Model WX-1000E *Stormscope* Series II system (WX-1000+ with ARINC-429 EFIS Option), P/N 78-8060-6085-7:

<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
78-8060-5900-8	*DISPLAY ASSEMBLY	1
78-8060-6086-5	PROCESSOR ASSEMBLY, including: 78-8060-5919-8 Expansion Interface PCB, ARINC-429 Option - installed in the processor	1
78-8051-9180-2	PROCESSOR TRAY ASSEMBLY	1
78-8051-9200-8	ANTENNA	1
78-8051-9206-5	DOUBLER PLATE, Antenna	1
78-8051-9208-1	GASKET, Antenna	1
78-8060-5755-6	HARDWARE PACKAGE, includes all connectors and mounting hardware.	1
78-8060-5793-7	OWNER'S MANUAL PACKET	1

* Available as an option only. Not supplied as part of the 78-8060-6085-7 package.

APPENDIX C

Stormscope® Series II/ARINC-429 Navaid Option

A. Introduction

NOTE

Stormscope Model WX-1000+ becomes a Model WX-1000E with the addition of an Expansion Interface PCB (expansion board) to the processor. The Navaid, ARINC-429 EFIS and ARINC-429 Navaid Options all require an expansion board. All references to Model WX-1000E in this Appendix pertain only to *Stormscope* Model WX-1000+ with the ARINC-429 Navaid Option installed.

The WX-1000+ *Stormscope* weather mapping system, with the ARINC-429 Navaid Option installed, has the capability to receive navigation data in the ARINC-429 data format and present it on the display. This option enables the WX-1000+ to interface with source navigational systems that provide ARINC-429 data outputs.

B. Description

The WX-1000+, with the ARINC-429 Navaid Option installed, has the capability to receive aircraft navigational data via an ARINC-429 serial data link. This data (standard ARINC-429 labels) is used to display navigation parameters on the screen simultaneously with the thunderstorm display. A twisted wire pair (429RX1A/B) provides the connection required for this serial data link.

NOTE

A synchro (XYZ) heading source is required when using this system.
The operating speed of the ARINC-429 receiver is low (12.5 KHz).

C. Installation

Section 2 of this manual (Installation) shall be followed when installing the WX-1000E *Stormscope* system. The information presented in this section is to be used as a supplement and referenced only for items unique to the ARINC-429 Navaid Option.

Cable lengths must be determined for the ARINC-429 twisted pair used to receive the ARINC-429 input. Cable and wire runs should be as short as practicable in order to minimize potential electrical interference. The ARINC-429 data cables are #22 AWG twisted, shielded cables. Cable 22TG3T14 (or equivalent) is suggested. The table provided in figure 2-12 lists some U.S. vendors who sell the required cable by the foot. Route the ARINC-429 cables referring to paragraph 2.11.6. Install the ARINC-429 cables referring to paragraph 2-12.

CAUTION

Information provided in the ARINC-429 Navaid Pin-Out Table (see figure C-1) is believed to be complete and accurate at the time of publishing. BFGoodrich FlightSystems has no control over product or software changes made by other manufacturers. It is the responsibility of the installer to confirm compatibility.

ARINC-429 Navaid Data Sources

The following paragraphs detail the ARINC-429 Navaid systems that are currently compatible with the *Stormscope* WX-1000E.

- **Trimble**
The WX1000E Navaid System will work with a TNL-7880 NPU, or an AR/ARN -148, with software version -071 using the low-speed ARINC-429 data output. For older systems with software versions ending in 011 or 051, consult the BFGFS Product Support Department. Software versions ending in 010 or X10 are not compatible.
- **Universal**
The WX1000E Navaid System will work with a UNS-1, UNS-1A, or most UNS-1B systems, provided that the software version is 13.X, 14.X, or 15.X, where "X" is equal to 1 through 9. Only the low-speed ARINC-429 data output on each system may be used.
- **Global**
The WX1000E Navaid System will work with a GNS-X, using its low-speed ARINC-429 data outputs. If the system is configured for high speed and the other interfaces will not allow the system to be reconfigured to low speed, then the system is not compatible. Additionally, the Global Navigation Management Units (NMUs) P/N 14141-0240 and 14141-0345 are not compatible either.

Pin-Outs of Typical ARINC-429 Data Sources

The following table provides a list of ARINC-429 navigation data sources and the wiring interconnect information required to interface to the *Stormscope* processor. The inputs to the *Stormscope* processor will always be pins 34 and 35 of plug 302. The connections at the source will vary from model to model. Refer to figure 2-19, System Interconnect, as an aid in interfacing the processor to an ARINC-429 source.

Typical ARINC-429 Data Source Pin-Out Table

ARINC-429 Navigation DataSource	Interconnect Wiring		Notes
	WX-1000E P302 pin 34 (ARINC-429 A)	WX-1000E P302 pin 35 (ARINC-429 B)	
Trimble NPU TR-7880	BP pin 32	BP pin 33	
Trimble AR/ARN-148	BP pin 32	BP pin 33	
GNS-X	Connector JB Pin A2	Connector JB Pin A3	
UNS-1 & UNS-1A	TP 9G	TP 9H	
UNS-1B	MP 4J	MP 4K	

Figure C-1. ARINC-429 Navaid Pin-Out Table

Navaid Setup (Navaid Option Installed)

Do the Navaid Setup procedure to select the proper navigation system. The Navaid Option will not operate properly if the wrong navigation system is selected. All of the navigation systems qualified by BFG FlightSystems (at time of purchase) to interface with the 429 Navaid Option in the *Stormscope* processor are available for selection. The default factory selection is Trimble 7880.

The display pushbuttons perform the following operations in NAV System Setup mode (figure C-2):

MENU	Switches the display back to the Service Menu.
NEXT	Moves the highlight bar to the next item on the list.
PREV	Moves the highlight bar to the previous item on the list.
SELECT	Selects the highlighted menu item. Select the navigation system as follows

1. Enter the Service Mode by powering up the *Stormscope* system while pressing display buttons 1 and 2 (figure 3-1). A Service Menu similar to figure 3-19 will be displayed.
2. Highlight "NAV System Setup" on the Service Menu and then press the SELECT pushbutton to display the NAV System Setup screen (figure C-2).

NOTE

A large dot is displayed to the left of the currently selected navigation system.
Refer to figure C-2 for a typical setup screen.

3. Highlight the desired navigation system and then press the SELECT pushbutton to enter the selection. The display will blink once and the large dot will move to the left of the high-lighted navigation system.
4. Press the MENU pushbutton to return to the Service Menu.

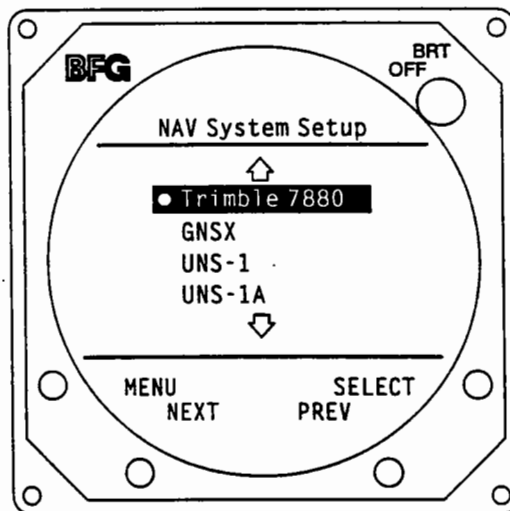


Figure C-2. NAV System Setup

ARINC-429 Set-Up Screen

The ARINC-429 Set-Up Screen may be reconfigured before operation with an ARINC-429 navigational system. During this set-up the installer will select the navigation items to be presented during normal *Stormscope* operation. The set-up selections will be driven both by the user's preferences and the capabilities of the ARINC-429 source to be utilized. The ARINC-429 Navaid Option has the capability to display any 6 out of a total of 14 possible navigation data items. Not all navigation sources can provide all 14 items. Information describing the Navaid Set-Up Screen is provided in chapter 3 of this manual. The Navaid Setup Screen is shown in figure 3-13. Procedures for configuring the Setup Screen are provided in paragraph 3.4.8. The 14 navigation data items are listed on the following page.

Navaid Setup Abbreviation

Rng
GS
ETE
Brg
XTK
ETA
Trk
WPT
MVar
MSA
MESA
Time
Lat
Long

Navaid Optional User Selections

Range to Active-Waypoint
Ground Speed
Estimated Time Enroute
Magnetic Bearing to Active Waypoint
Crosstrack Error
Estimated Time of Arrival
Magnetic Track Angle
Waypoint Identifier
Magnetic Variation at Present Position
Minimum Safe Altitude
Minimum Enroute Safe Altitude
Stormscope System Stopwatch
Latitude
Longitude

D. Operation

The primary purpose of the WX-1000E *Stormscope* system is to alert the flight crew to the presence of thunderstorm activity. The object is to provide a means for the pilot to make thunderstorm avoidance decisions. The system detects lightning data 360 degrees around the aircraft to a distance of 200 nautical miles and presents this data on the CRT display. The purpose of the ARINC-429 Navaid Option is to provide navigational information to the *Stormscope* user simultaneously with the real-time thunderstorm data. The navigation data used with this option is received from an ARINC-429 navigational system.

ARINC-429 Data Screen

The ARINC-429 Data Screen, shown in figure C-3, provides the capability to verify that valid Navaid data is being received. The ARINC-429 Data Screen provides a list of all ARINC-429 labels that are presently being received from the source navigational system. The user can page up and down to access the labels that apply (reference ARINC-429 Set-Up Screen). The labels are listed in numerical sequence. The ARINC-429 data word is provided under the DATA column. This data will vary as the associated navigation parameter varies. If no data is being supplied for a particular navigation item, the label will not appear on the screen. The ARINC-429 source navigational system also transmits an SSM (sign status matrix) code for each label. This label appears on the Data Screen as a type of error code and is used during troubleshooting.

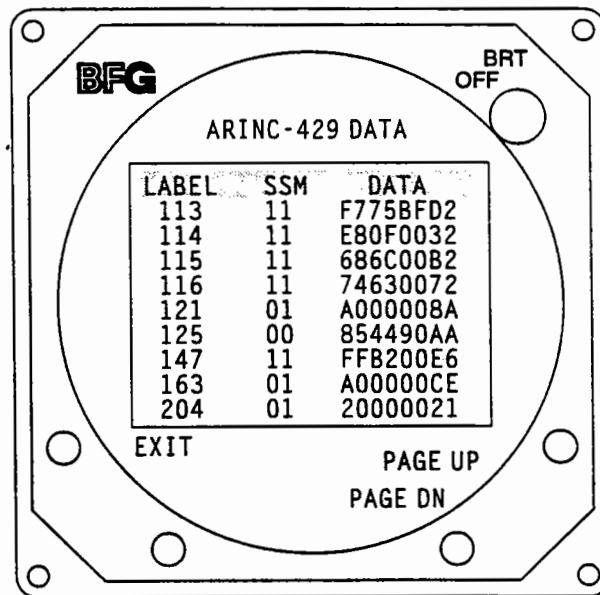


Figure C-3. Typical ARINC-429 Navaid Data Screen

The ARINC-429 Data Screen is accessed via the Service Menu as follows:

1. Enter the Service Mode by powering up the *Stormscope* system while holding display buttons 1 and 2 depressed (refer to figure 3-1 for button identification).
2. Press NEXT until the highlight bar on the Service Menu is on "NAV Sys Raw Data" then press SELECT.
3. The ARINC-429 DATA Screen will be displayed with no data.
4. Press START on the ARINC-429 DATA Screen.
5. The message "IN PROCESS....." will be displayed.
6. The processor then analyzes 5 seconds of raw input data and presents it as shown in figure C-3.
7. Use PAGE UP and PAGE DN to page through the list of ARINC-429 labels being received.
8. Press EXIT to leave the ARINC-429 DATA Screen. This procedure can then be performed over again with another 5 seconds of raw data if desired.

<u>LABEL NAME</u>	<u>OCTAL LABEL</u>	<u>COMMENTS</u>
Distance	001	
ETE	002	
Ground Speed	012	
Windspeed	015	
Wind Direction	016	
Tacan Frequency	033	
VOR Frequency	034	
DME Frequency	035	
Set Latitude	041	
Set Longitude	042	
Set Heading	043	
Data Record Header	074	
Active WPT	075	
Selected Heading	101	
ILS Final CVS	105	
Pseudo ILS CVS	110	
Message Checksum	113	
True Desired TRK	114	
True WPT BRG	115*	
Cross TRK Dist	116*	
Vert Deviation	117	
Steering	121	
Vert Cmd Sig	122	
GMT	125	
Mag Variation	147*	
GMT (Binary)	150	
Wind on Nose	163	
Pseudo Localizer	173	
Pseudo Glidescope	174	
Baro-Corr Alt	204	
True Airspeed	210	
Static Air Temperature	213	
Dist to WPT	251*	
Time to WPT	252*	
Date	260	
Status	270	
OSS Mode Cntrl or Status	271	
Man Statn Desel	272	
Sel Mem Addr	273	
LORAN Stat Desel	274	
Status	275	
Station Type, class, freq	300	
Message characters 7-9	301	
Message characters 10-12	302	

Figure C-4. Navaid-Related ARINC-429 Labels.

<u>LABEL NAME</u>	<u>OCTAL LABEL</u>	<u>COMMENTS</u>
Message length, type, number	303	
Message characters 1-3	304	
Message characters 4-6	305	
Waypoint Latitude	306*	
Waypoint Longitude	307*	
Present Position (Lat)	310*	
Present Position (Lon)	311*	
Groundspeed	312*	
Track Angle (True)	313*	
True Heading	314*	
Wind Speed	315	
Wind Direction	316	
Magnetic Heading	320	
Drift Angle	321	
Waypoint 0 Latitude or Pitch	324	
Waypoint 0 Longitude or Roll	325	
Waypoint 1 Latitude	326*	Trimble Unit Only
Waypoint 1 Longitude	327*	Trimble Unit Only
Waypoint 2 Latitude	330*	Trimble Unit Only
Waypoint 2 Longitude	331*	Trimble Unit Only
Waypoint 3 Latitude	332*	Trimble Unit Only
Waypoint 3 Longitude	333*	Trimble Unit Only
Waypoint 4 Latitude	334*	Trimble Unit Only
Waypoint 4 Longitude	335*	Trimble Unit Only
Waypoint 5 Latitude	336*	Trimble Unit Only
Waypoint 5 Longitude	337*	Trimble Unit Only
Waypoint 6 Latitude	340*	Trimble Unit Only
Waypoint 6 Longitude	341*	Trimble Unit Only
Waypoint 7 Latitude	342*	Trimble Unit Only
Waypoint 7 Longitude	343*	Trimble Unit Only
Waypoint 8 Latitude	344*	Trimble Unit Only
Waypoint 8 Longitude	345*	Trimble Unit Only
Waypoint 9 Latitude	346*	Trimble Unit Only
Waypoint 9 Longitude	347*	Trimble Unit Only
Distance to Destination	351*	
Time to Destination	352*	
EFIS File	357	
N/S Velocity	366	
E/W Velocity	367	
Vendor/Unit ID	371	

* SSM code must be "11" for information to be valid.

Figure C-4. Navaid-Related ARINC-429 Labels (Continued).

Expansion Tests Mode

The ARINC-429 Navaid interface circuitry can be tested from the Expansion Tests Mode. The ARINC-429 Navaid test uses the same test and test procedure provided for the Navaid Option in paragraph 3.5.6. Refer to paragraph 3.5.6 to test the ARINC-429 Navaid interface portion of the WX-1000E processor. Expansion Tests - Screen 2 is different for the ARINC-429 Navaid test and is shown in figure C-5.

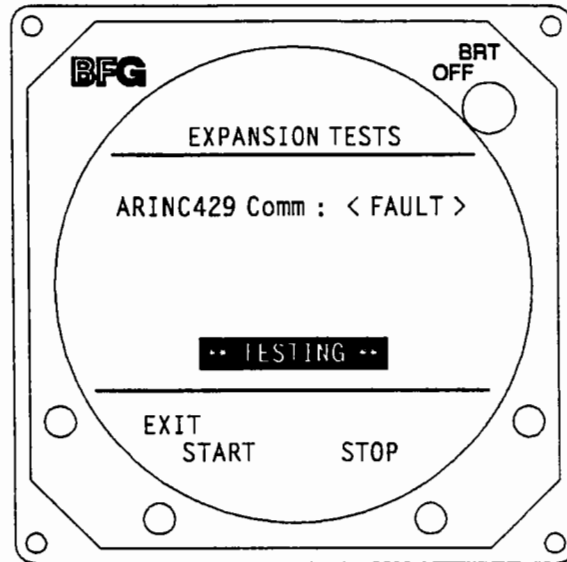


Figure C-5. Expansion Tests - Screen 2 (ARINC-429 Option Installed)

E. Maintenance

Expansion Board Testing

The bench setup is the same as that outlined in Section 5.3.3, except that the WX-PA does not have to be connected. If it is already connected, it can be switched off. A WX-1000 display is required for bench testing. The WX-1000 display provides the necessary display buttons and the capability to display the processor fault log.

1. Enter the Service Mode by powering up the *Stormscope* system while holding display buttons 1 and 2 (the left two buttons) depressed.
2. Press NEXT until the highlight bar on the Service Menu is on Expansion Tests then press SELECT.
3. The Expansion Tests mode will display the prompt:

ATTACH EXP TEST PLUG
TO BENCH TEST POD P302

Press TEST to continue

4. Connect the communications test plug (BFGoodrich FlightSystems P/N 78-8060-5925-5) to the bench test pod connector marked N/C in figures 5-3 and 5-6. (This is connector P302).

The communications test plug consists of a 25 pin D connector attached to a small printed circuit board (represented by figure 5-7). There is an RS-232C/RS-422 switch on the board that can be disregarded during ARINC-429 testing.

5. Press TEST, then press START.

The system will begin testing the ARINC-429 interface circuitry once each second. "TESTING" will appear in the center of the display and the results of the last test will be shown as:

ARINC-429 Comm:<OK>
 or
 ARINC-429 Comm:<FAULT>

The FAULT message indicates a malfunction in the ARINC-429 circuitry.

6. Press STOP to discontinue the testing.

If the ARINC-429 comm test was <OK>, no further checks are required. The expansion board test is complete.

Adjustments

The ARINC-429 receiver speed should be set to low speed (12.5 kHz) via a DIP switch on the expansion board. In the factory preset condition the receiver speed is set low. Perform the following procedure to verify the DIP switch setting if required:

1. Remove the expansion board from the WX-1000E processor per paragraph 5.5-A.
2. Position the DIP switches shown in figure C-6 to the appropriate positions to select the ARINC-429 receiver operating speed. Refer to the table provided in figure C-7 when setting the DIP switches.
3. Reinstall the expansion board into the WX-1000E processor per paragraph 5.5-A.

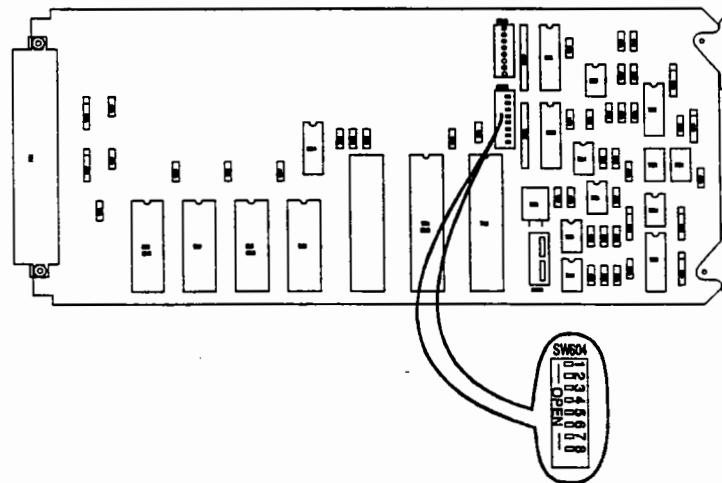


Figure C-6. Expansion Interface PCB (ARINC-429 Adjustments)

ARINC-429 Data Speed	DIP Switches - SW 604							
	1	2	3	4	5	6	7	8
Receive - low speed	1	1	X	X	X	X	1	1
0 = Open (Off), 1 = Closed (On), X = Switch position does not matter.								

Figure C-7. ARINC-429 DIP Switch Positions

Performance Testing

The performance test procedures of paragraph 5.7.3 should be performed to verify proper installation of the *Stormscope* system.

Troubleshooting

Verify that the WX-1000 display is presenting navigation data properly as described in paragraph 5.7.3. If the Navaid data is not being presented properly, troubleshoot as directed below.

1. Enter the Service Mode by powering up the *Stormscope* system while holding display buttons 1 and 2 depressed.
2. Press NEXT until the highlight bar on the Service Menu is on "NAV System Setup".
3. Press SELECT and verify that the proper navigation system is selected.
4. Press MENU to return to the Service Menu.
5. Press NEXT until the highlight bar on the Service Menu is on "Expansion Data".
6. Press SELECT and observe display for "ARINC-429 (RX): Lo Speed". If "Hi Speed" is displayed, refer to the Adjustments paragraph in this appendix and set the speed to low (12.5 kHz).
7. Press MENU to return to the Service Menu.
8. Press NEXT until the highlight bar on the Service Menu is on "NAV Sys Raw Data" then press SELECT.
9. The ARINC-429 DATA Screen will be displayed.
10. Press START on the ARINC-429 DATA Screen.
11. The message "IN PROCESS....." will be displayed.
12. The processor then analyzes 5 seconds of raw input data and presents it as shown in figure C-3.
13. Verify that labels and data for the required navigation items are present. Refer to figure C-4, ARINC-429 Navaid Labels.

14. If the required labels and valid data are being received, the fault may reside in the *Stormscope* processor, display, or interconnecting cables. Perform Bench Testing as specified in section E of this Appendix. Refer to Section 5 of this manual for troubleshooting information.
15. If the required labels and data are not present, disconnect the cable from processor plug 302 and connect it to an ARINC-429 Bus Analyzer.
16. Verify that the Analyzer is receiving good ARINC-429 data. If good data is received, the fault resides in the *Stormscope* processor. If good data is not received, replace the cable and test again for good data.
17. If good data is received using the replacement cable, the cable was faulty. If good data is still not received, the fault resides in the source navigational system.

F. Parts List

The following parts are supplied by BFGoodrich FlightSystems with a Model WX-1000E *Stormscope* Series II system (WX-1000+ with ARINC-429 Navaid Option), P/N 78-8060-6091-5:

<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
78-8060-5900-8	DISPLAY ASSEMBLY	1
78-8060-6092-3	PROCESSOR ASSEMBLY, including: 78-8060-6101-2 Expansion Interface PCB, ARINC-429 Navaid Option - installed in the processor.	1
78-8051-9180-2	PROCESSOR TRAY ASSEMBLY	1
78-8051-9200-8	ANTENNA	1
78-8051-9206-5	DOUBLER PLATE, Antenna	1
78-8051-9208-1	GASKET, Antenna	1
78-8060-5755-6	HARDWARE PACKAGE, includes all connectors and mounting hardware.	1
78-8060-5793-7	OWNER'S MANUAL PACKET	1

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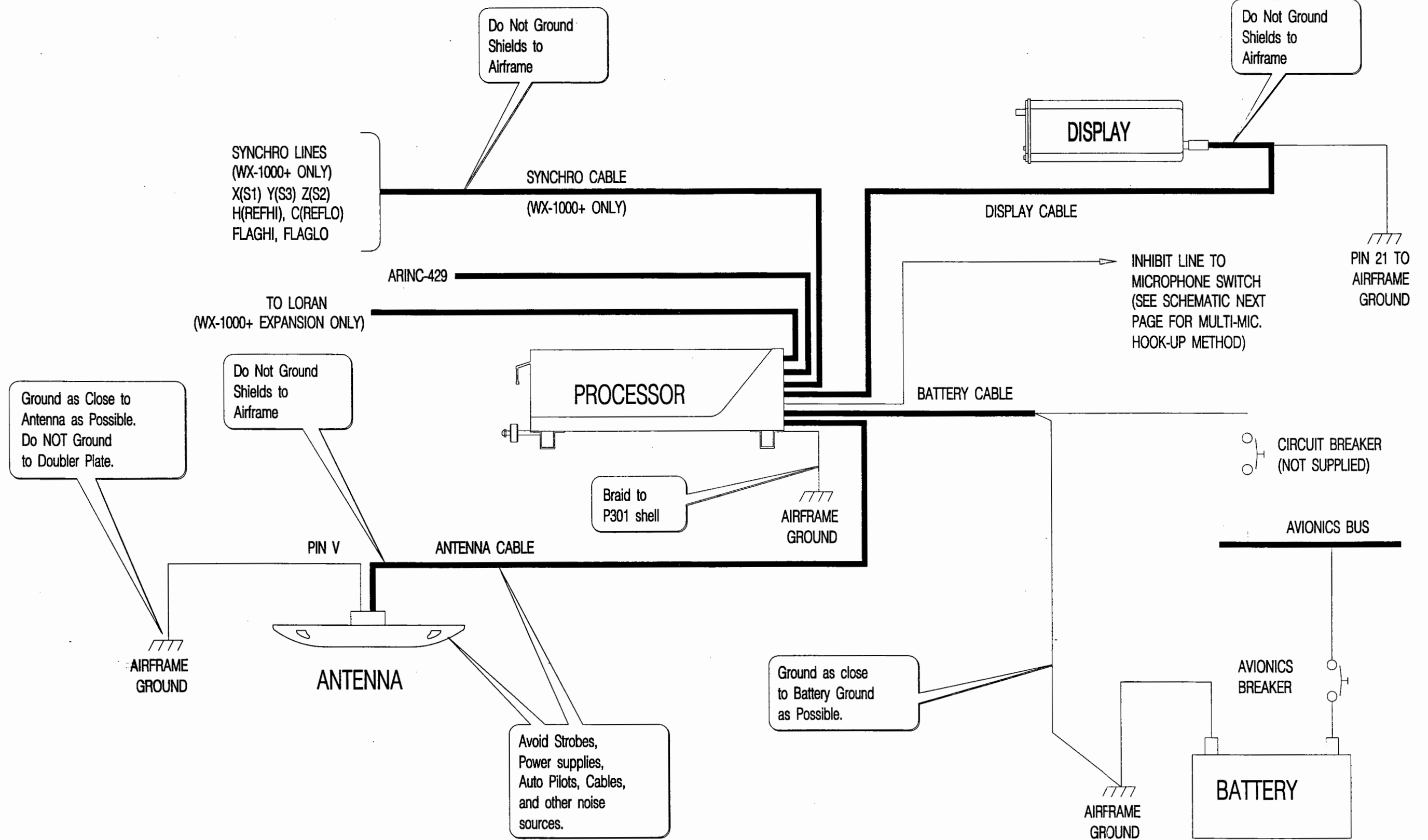
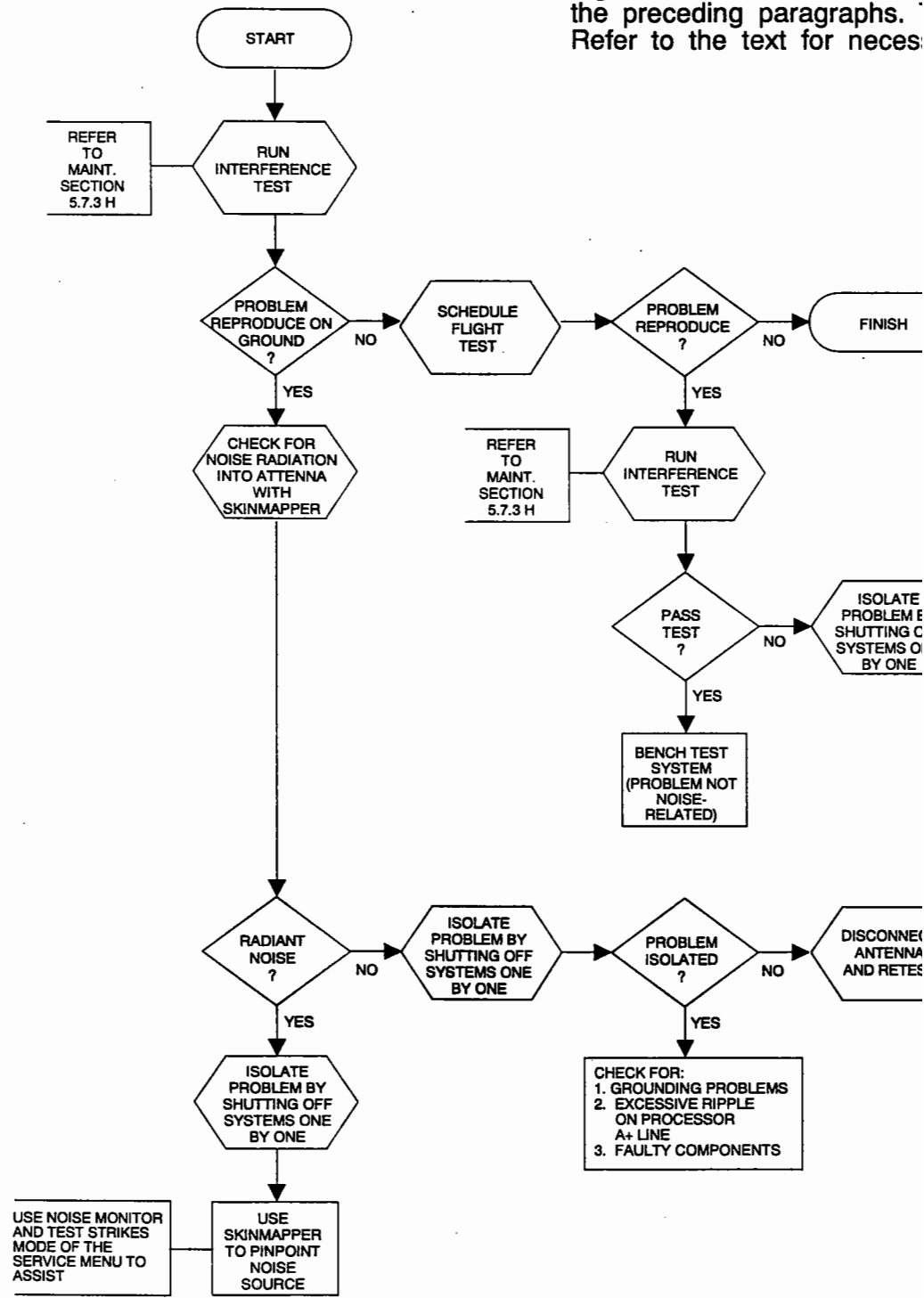


Figure 2-18. System Overview

Figure 5-22 is a troubleshooting flowchart that summarizes the information in the preceding paragraphs. Refer to the text for necessary details.



Summarizes the information in the preceding paragraphs. Refer to the text for necessary details.

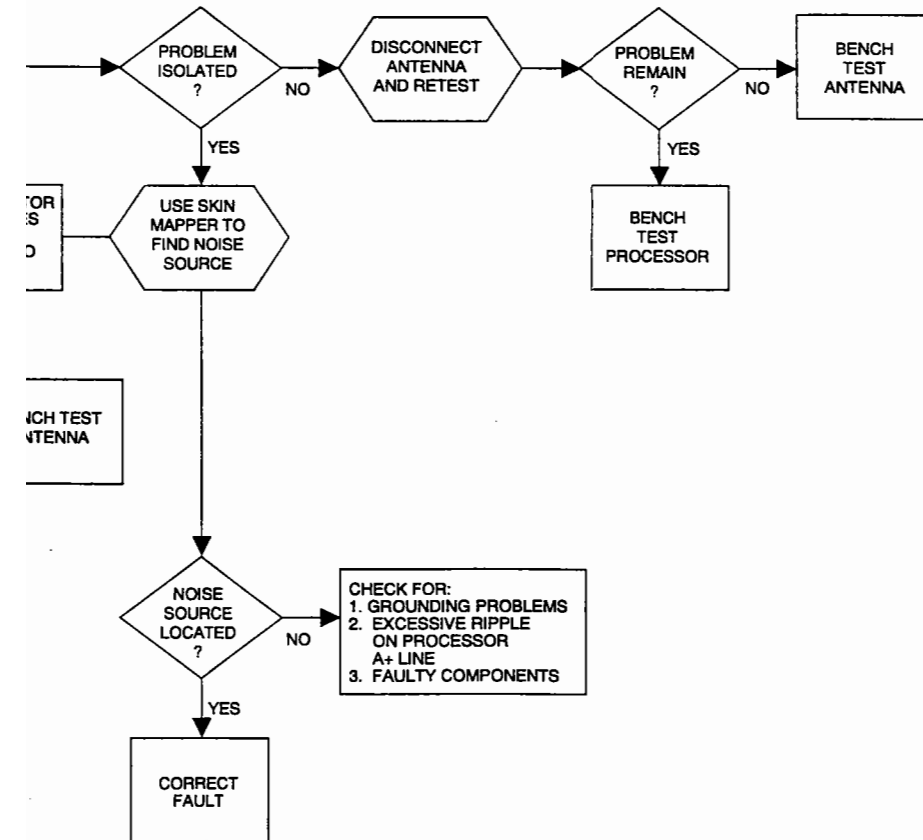


Figure 5-22. Troubleshooting Flowchart

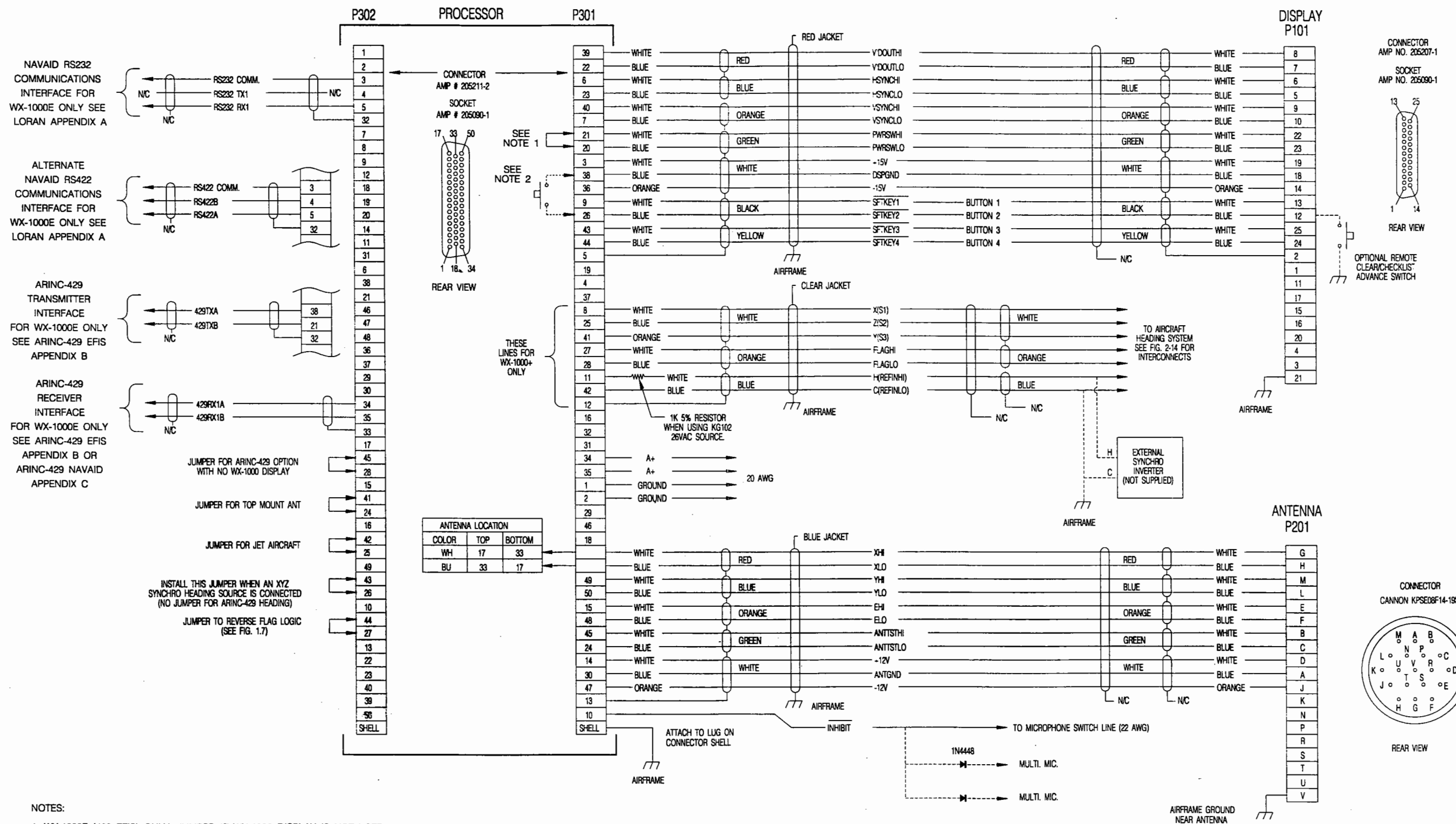


Figure 2-19. System Interconnect