SKYWATCH® HP

Traffic Alert/Advisory System

SKY899 Installation Manual

This manual contains installation instructions and recommended flightline maintenance information for the SKY899 Traffic Alert/Advisory System. This information is supplemented and kept current by Change Notices, Service Bulletins, and Service Memos published by BFGoodrich Avionics Systems.

BFGoodrich Aerospace

009-11900-001 (Rev. A)

BFGoodrich Avionics Systems, Inc.
5353 52nd Street, S.E.
Grand Rapids, MI USA 49512

30 April 2001

ABOUT THIS MANUAL

Chapter 1 – General Information

This chapter includes equipment specifications and a functional description. It describes the various hardware configurations and includes a list of items furnished and items required but not supplied with the equipment.

Chapter 2 - Installation

This chapter contains instructions for unpacking the equipment and inspection for in-shipment damage. It also includes information required to locate, assemble and install the equipment.

Chapter 3 – Installation Checkout

This chapter contains instructions for doing post-installation and return to service checkout of the SKY899 using the BFGoodrich Avionics Systems TT391 Flightline Tester.

Chapter 4 – Maintenance

This chapter contains general flightline maintenance procedures. It includes periodic maintenance and troubleshooting; instructions for calibrating the directional antenna and instructions for the return of defective components.

Appendix A – Signal and Cable Characteristics

This appendix defines the electrical characteristics of all input and output signals.

Appendix B – Environmental Qualification Form

This appendix has the environmental qualification forms for the TRC899, NY156 & NY164 antennas, and WX-1000/SKY497 display.

Appendix C – Installation Checkout Using The TCAS-201 Ramp Test Set

This appendix contains instructions for doing post-installation and return to service checkout of the SKY899 using the IFR Systems TCAS-201 Ramp Test Set (with TCAS I firmware).

Appendix D – Installation Checkout Using The TIC T-49C Flightline Tester

This appendix contains instructions for doing post-installation and return to service checkout of the SKY899 using the TIC T-49C Flightline Tester.

Appendix E – Using The Terminal Device

This appendix contains instructions for using the Terminal Device for installation, testing or troubleshooting of the SKY899.

Appendix F – Installation Checkout Using an Alternate Display

This appendix contains instructions for doing post-installation and return to service checkout of the SKY899 using an Alternate Display.

Trademarks

LIST OF EFFECTIVE PAGES

Dates of original and changed pages are: Original (Rev. A) ..... 30 April 2001

NOTE

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FOREWORD

This manual provides information intended for use by persons who, pursuant to current regulatory requirements, are qualified to install this equipment. Because installations vary depending on a particular aircraft, this manual is intended as a guideline. Standard installation practices prescribed in FAA Advisory Circular No. 43.13 must be followed. If further information is required, contact:

BFGoodrich Avionics Systems
Attn: Field Service Engineering
5353 52nd Street, S.E.
Grand Rapids, MI USA 49512
Tel. (800) 453-0288 or (616) 949-6600

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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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

This section contains a functional description of the BFGoodrich Avionics Systems SKY899 traffic alert/advisory system sensor, describes the various hardware and software configurations, outlines the main features of the system, and provides a system block diagram. The SKY899 is a new generation traffic alert/advisory system that has different inputs and outputs and it requires different wiring than the SKY497. Connector P1 is keyed differently to prevent connection to the wrong TRC.

NOTES

1. The SKY899 is designed to be installed as a TCAS I traffic alert system or as a TAS traffic advisory system. The system installation differences are as follows:
   - TCAS I installations requires an alternate display device (i.e., EFIS, MFD, IVSI, weather radar indicator) FAA approved for displaying TCAS I information and the antenna must be an NY156 directional antenna.
   - TAS installations can have an alternate display device, the WX-1000/SKY497 display, or both as the primary means displaying traffic information. Either the NY156 or NY164 directional antenna can be used.
2. Contact Field Service Engineering at 1-800-453-0288 or 1-616-949-6600 for approved displays and software version requirements of the TRC899.
3. The SKY899 does not track intruder aircraft approaching at a closure rate greater than 1200 knots.
4. This section provides installation information for the SKY899 using the WX-1000/SKY497 Display. If using an alternate display device refer to manufacturer instructions for installation details.
5. When interfacing to a weather radar indicator via the BFGoodrich Avionics Systems RGC250 (Radar Graphics Computer) refer to the RGC250 Installation Manual for installation instructions. RGC250 must have software version 1.5 or later.
6. When an alternate display device is installed the service menu can not be accessed via the display, therefore a terminal device (i.e., laptop) is required for system setup and post-installation checkout (refer to appendix E).
7. When planning ARINC-429 receiver interfaces note that:
   - The equipment connected to receive channels 1 and 2 must be the same speed (12.5 or 100 kHz).
   - The equipment connected to receive channels 3 and 4 must be the same speed (12.5 or 100 kHz).
   - Channel 5 receiver is independent of the other receivers and can be set to 12.5 or 100 kHz.
8. In order to use ADS-B SKYWATCH HP requires a GPS input that is GAMA or ARINC-743A compliant.

1.2 FUNCTIONAL DESCRIPTION

The BFG Avionics Systems SKYWATCH® HP SKY899 is a new generation airborne traffic alert/advisory system that increases the active-mode surveillance range over the SKY497 system from 20 nmi to 35 nmi and adds Automatic Dependent Surveillance-Broadcast (ADS-B) surveillance mode. The SKY899 continuously monitors the dedicated data link frequency (1090 MHz) for ADS-B mode S extended squitter messages within 50 nmi. The ADS-B message contains navigational information about the intruder aircraft including GPS position, ident, ground speed, and intent. The SKY899 uses this navigational information along with its own aircraft GPS navigation data to calculate the relative position of the intruder to augment its active ATCRBS surveillance of the intruder. ADS-B surveillance enhances the traffic alert/advisory abilities by increasing the accuracy of the active-mode surveillance. The SKY899 does not require a mode S transponder, ADS-B capable or otherwise to perform its ADS-B surveillance.

The SKY899 advises the flight crew where to look for aircraft that may pose a collision threat. It is intended for use by corporate and general aviation aircraft. SKY899 alerts the flight crew to nearby transponder equipped aircraft and assists the pilot in the visual acquisition of aircraft that may represent a danger. Traffic information out to a selected range is graphically displayed on the display. Using shapes (i.e., Traffic Advisory = solid circle; Other Traffic = open diamond) and text, the display shows the relative position of threat aircraft.

1.3 PHYSICAL DESCRIPTION

The SKY899 System consists of the following main components:

- Transmitter Receiver Computer
- System Configuration Module
- Alternate Display (or optional monochrome WX-1000/SKY497 display)
- Directional Antenna, NY156 or NY164 (depending on TCAS I or TAS installation)

SKY899 is an active system that operates as an aircraft-to-aircraft interrogation device. The SKY899 equipment interrogates transponders in the surrounding airspace similar to ground based radars. When replies to these active interrogations are received, the responding aircraft's range, altitude, and closure rates are computed to plot traffic location and predict collision threats. The effective active range is approximately 20 nmi. The SKY899 does not transmit ADS-B interrogations, in order to transmit your aircraft position you must have a mode S transponder capable of ADS-B interrogations.

Figure 1-1 shows the SKY899 vertical display modes used to display intruding aircraft. The unrestricted altitude of the surveillance zone is ±10,000 ft, but the display is only capable of showing to ±9,900 ft. A simplified block diagram of the system and their relationships is shown in figure 1-2.

Major differences between SKYWATCH and SKYWATCH HP are listed below:

Category	SKY497	SKY899
• Active ATCRBS Display Range	6 nmi display range	15 nmi display range
• Active ATCRBS Surveillance Range	11 nmi surveillance range	35 nmi surveillance range
• Active ATCRBS Interrogation Power	Low-power interrogations	High-power interrogations
• Number of Whisper-Shout Steps	4 Whisper-Shout steps	7 Whisper-Shout steps
• Active ATCRBS Interference Limiting	No interference limiting	TCAS I for TAS interference limiting
• ADS-B Surveillance	None	ADS-B surveillance range 50 nmi
• Performance	Single-sensor target tracking	Multisensor target tracking
• Closure Rate	900 kn closure rate	1200 kn closure rate
• Antenna Configurations	Single directional antenna	Multiple antenna configurations via external ASU (future option)
• Aircraft Power Input	11 V dc to 34 V dc	18 V dc to 32 V dc
• Stepper Compass Input	Accepts stepper compass input	Will not accept stepper compass input
• Radio Altitude Input	Accepts only ARINC 429 radio altitude	Accepts both analog and ARINC 429 radio altitude
• Display Ranges (WX-1000 CDU)	2 nmi and 6 nmi	2 nmi, 6 nmi, and 15 nmi
• Installation Configuration Data	Connector configuration pins	System configuration module
• Vertical Display Modes	Normal, Above, & Below ±9,000 ft	Normal, Above, Below & Unrestricted ±9,900 ft

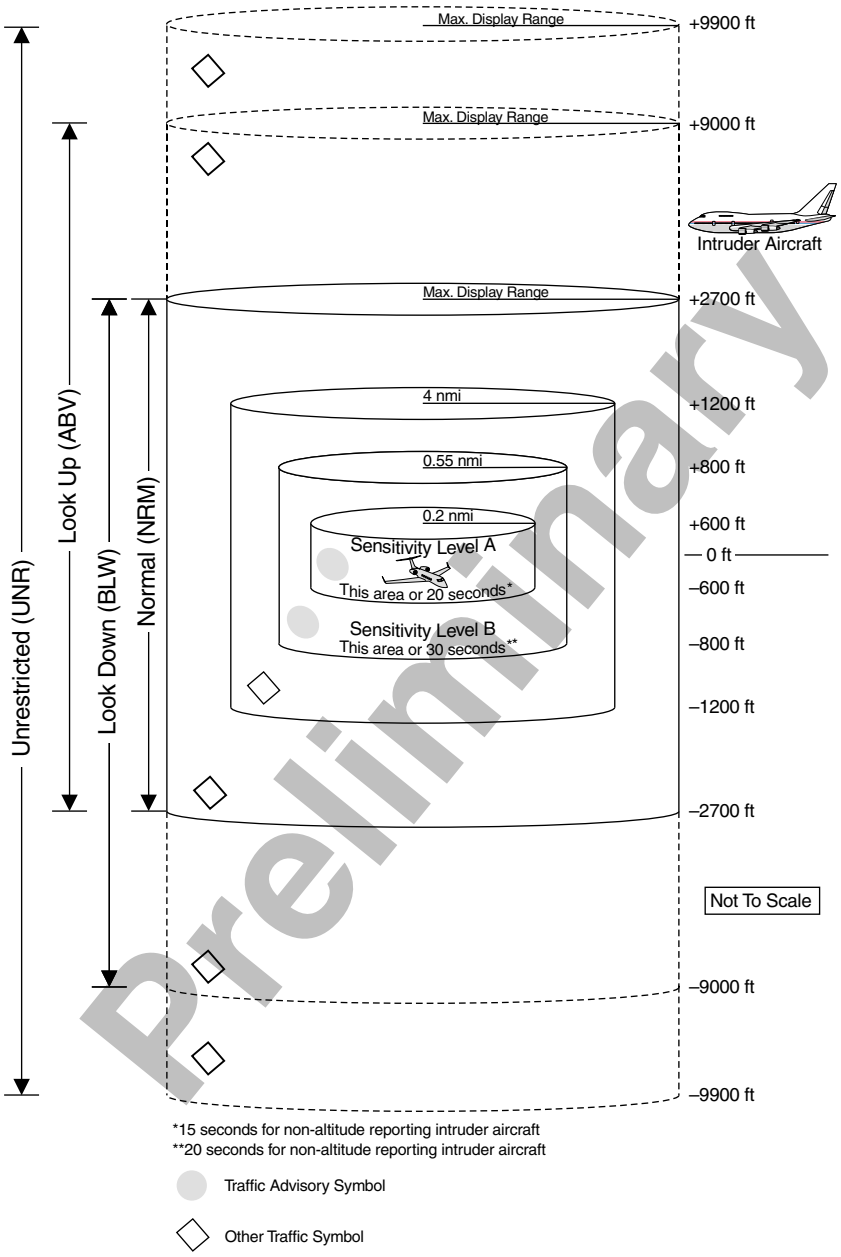
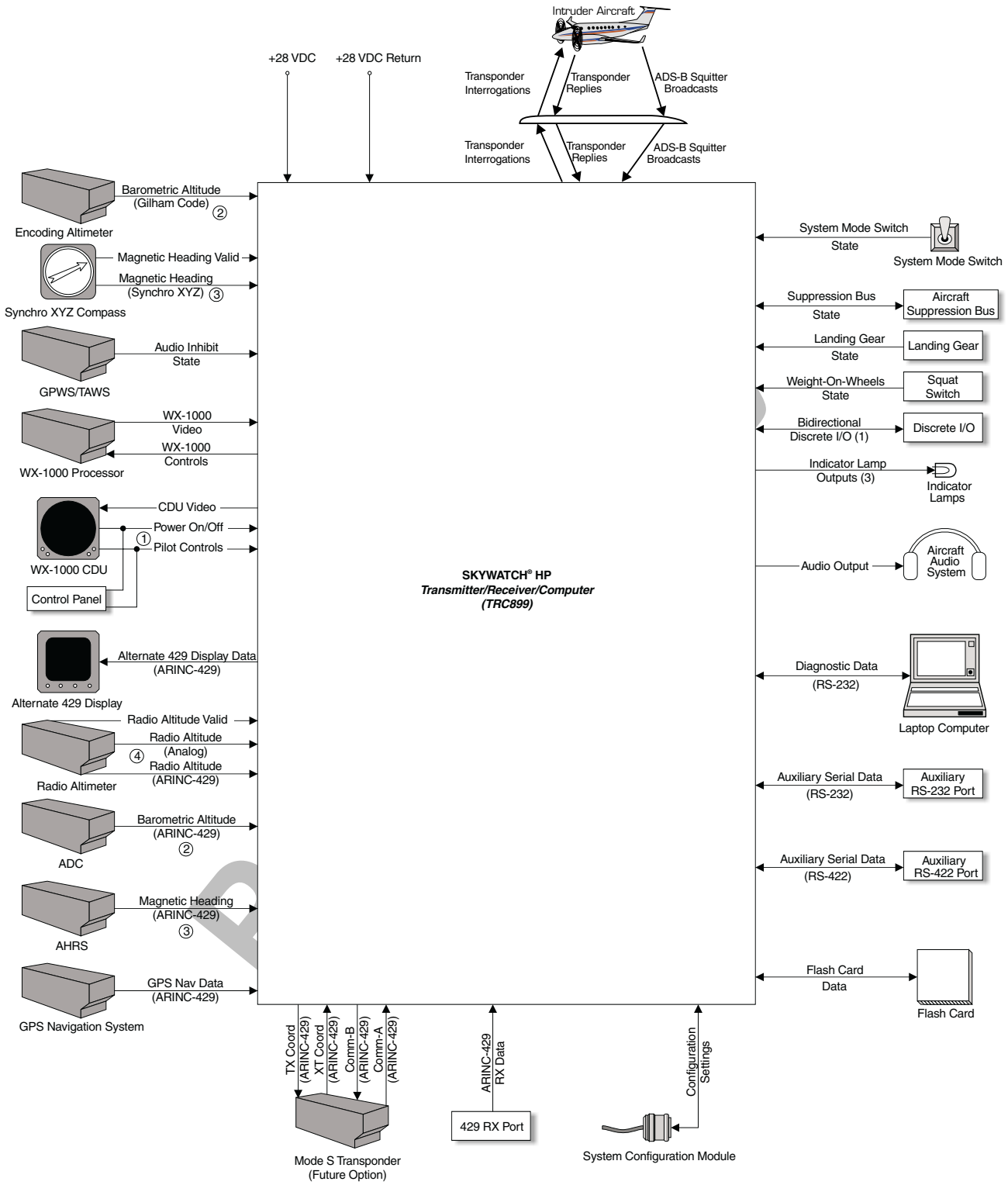


Figure 1-1. Vertical Display Modes



Notes:

① Power On/Off and Pilot Controls are wired discretely when using an external display
② Barometric altitude can be obtained from any of these sources
③ Magnetic heading can be obtained from any of these sources
④ Radio altitude can be obtained from analog or ARINC 429 sources

Figure 1-2. SKY899 System Block Diagram

The following table identifies the components which make-up the SKY899 system.

Table 1-1. SKY899 System

COMPONENT	PART NUMBER
TRC899 Transmitter Receiver Computer	805-11900-001
System Configuration Module	814-18005-001*
WX-1000/SKY497 Display (Optional)	78-8060-5900-x**
Directional Antenna	
NY156	805-10003-001
NY164	805-10890-001

* System Configuration Module is included in the installation kit P/N 817-11900-xxx (see table 1-2).
** Dash numbers identify different versions (refer to para 1.4.2).

1.3.1 TRC899 Transmitter Receiver Computer P/N 805-11900-xxx

The TRC is mounted in a mounting tray supplied with the installation kit (see table 1-2). The standard tray (figure 1-3) will meet the requirements for fixed wing aircraft. A ruggedized version of the tray (figure 1-4) is required for rotorcraft installations.

To meet different space requirements, the I/O signal connector (P1) will accommodate either a straight or right-angle backshell. TRC installation kits (see table 1-2) include either a straight backshell or right-angle backshell (see figure 1-5).

Table 1-2. TRC Installation Kit P/N 817-11900-xxx

KIT P/N	DESCRIPTION	QUANTITY	PART NUMBER
817-11900-001	For Installation on Fixed-Wing Aircraft with Straight 1.5 inch (3.8 cm) Backshell Consists of:		
	Standard Mounting Tray Assembly	1	805-10870-001
	1.5" (3.8 cm) Straight Backshell	1	613-10039-001
	I/O Connector, 100-Position, Female, (Mil-C-38999 Series III)	1	605-10251-001
	(Includes #22D Crimp Terminals)		
	Spare Terminals for I/O Connector	10	M39029/56-348
	Power Connector, 3-Position, Straight Plug	1	MS3126F12-3S
	(Includes #16 Crimp Terminals)		
	Spare Terminals for Power Connector (M39029/32-247)	2	607-10018-001
	System Configuration Module Assembly	1	814-18005-001
817-11900-002	For Installation on Fixed-Wing Aircraft with Straight 2.5 inch (6.4 cm) Backshell Consists of:		
	Standard Mounting Tray Assembly	1	805-10870-001
	2.5" (6.4 cm)Straight Backshell	1	613-10042-001
	I/O Connector, 100-Position, Female, (Mil-C-38999 Series III)	1	605-10251-001
	(Includes #22D Crimp Terminals)		
	Spare Terminals for I/O Connector	10	M39029/56-348
	Power Connector, 3-Position, Straight Plug	1	MS3126F12-3S
	(Includes #16 Crimp Terminals)		
	Spare Terminals for Power Connector (M39029/32-247)	2	607-10018-001
	System Configuration Module Assembly	1	814-18005-001
817-11900-003	For Installation on Fixed-Wing Right-Angle (90°) Backshell Consists of:		
	Standard Mounting Tray Assembly	1	805-10870-001
	Right-Angle (90°) Backshell	1	613-10043-001
	I/O Connector, 100-Position, Female, (Mil-C-38999 Series III)	1	605-10251-001
	(Includes #22D Crimp Terminals)		
	Spare Terminals for I/O Connector	10	M39029/56-348
	Power Connector, 3-Position, Straight Plug	1	MS3126F12-3S
	(Includes #16 Crimp Terminals)		
	Spare Terminals for Power Connector (M39029/32-247)	2	607-10018-001
	System Configuration Module Assembly	1	814-18005-001
817-11900-004	For Installation on Rotorcraft with 2.5 inch (6.4 cm) Backshell		
	Ruggedized Mounting Tray Assembly	1	805-10870-003
	2.5" (6.4 cm)Straight Backshell	1	613-10042-001
	I/O Connector, 100-Position, Female, (Mil-C-38999 Series III)	1	605-10251-001
	(Includes #22D Crimp Terminals)		
	Spare Terminals for I/O Connector	10	M39029/56-348
	Power Connector, 3-Position, Straight Plug	1	MS3126F12-3S
	(Includes #16 Crimp Terminals)		
	Spare Terminals for Power Connector (M39029/32-247)	2	607-10018-001
	System Configuration Module Assembly	1	814-18005-001
817-11900-005	For Installation on Rotorcraft with Right-Angle (90°) Backshell Consists of:		
	Ruggedized Mounting Tray Assembly	1	805-10870-003
	Right-Angle (90°) Backshell	1	613-10043-001
	I/O Connector, 100-Position, Female, (Mil-C-38999 Series III)	1	605-10251-001
	(Includes #22D Crimp Terminals)		
	Spare Terminals for I/O Connector	10	M39029/56-348
	Power Connector, 3-Position, Straight Plug	1	MS3126F12-3S
	(Includes #16 Crimp Terminals)		
	Spare Terminals for Power Connector (M39029/32-247)	2	607-10018-001
	System Configuration Module Assembly	1	814-18005-001

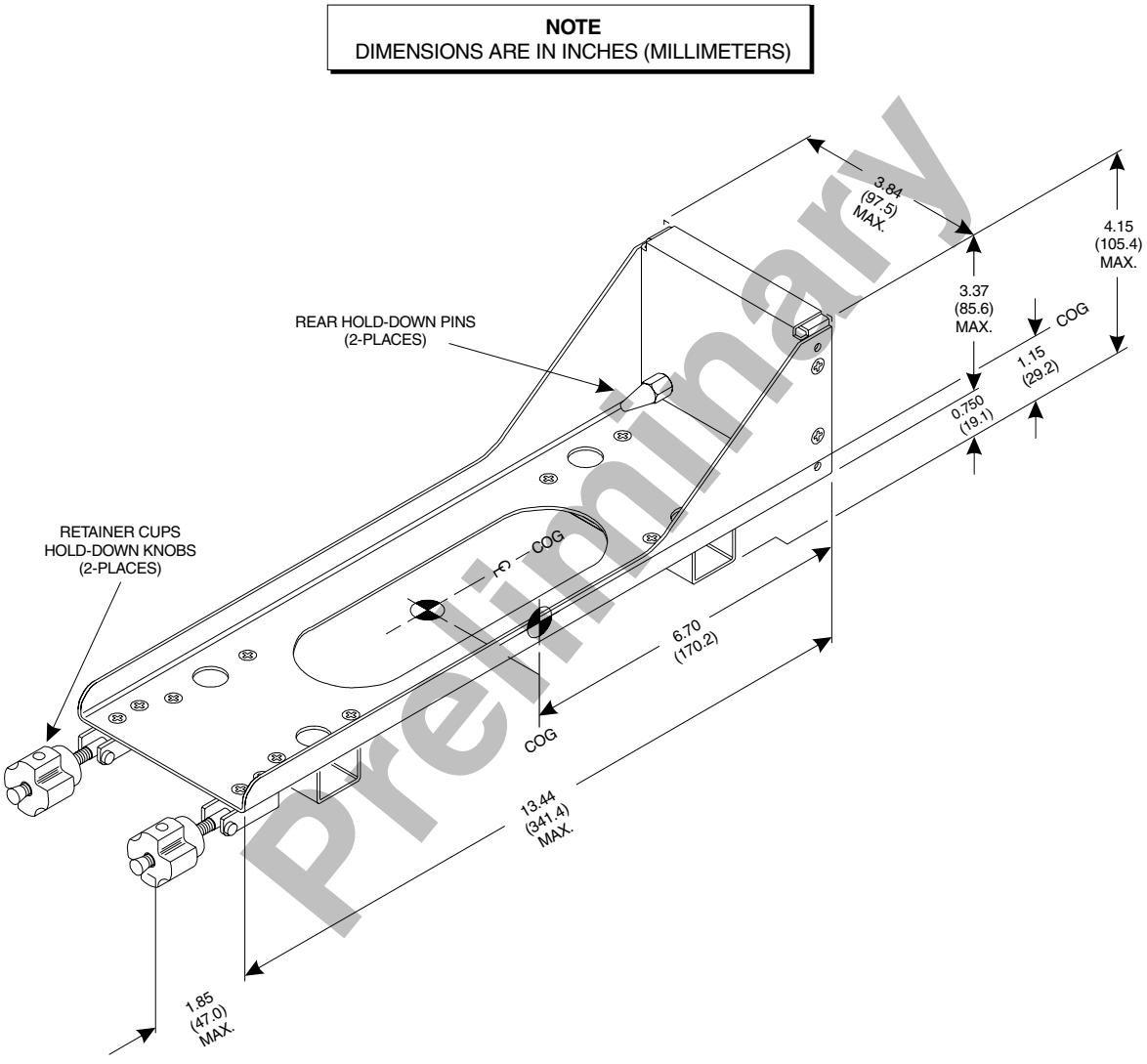


Figure 1-3. Standard TRC Mounting Tray (P/N 805-10870-001)

NOTE
DIMENSIONS ARE IN INCHES (MILLIMETERS)

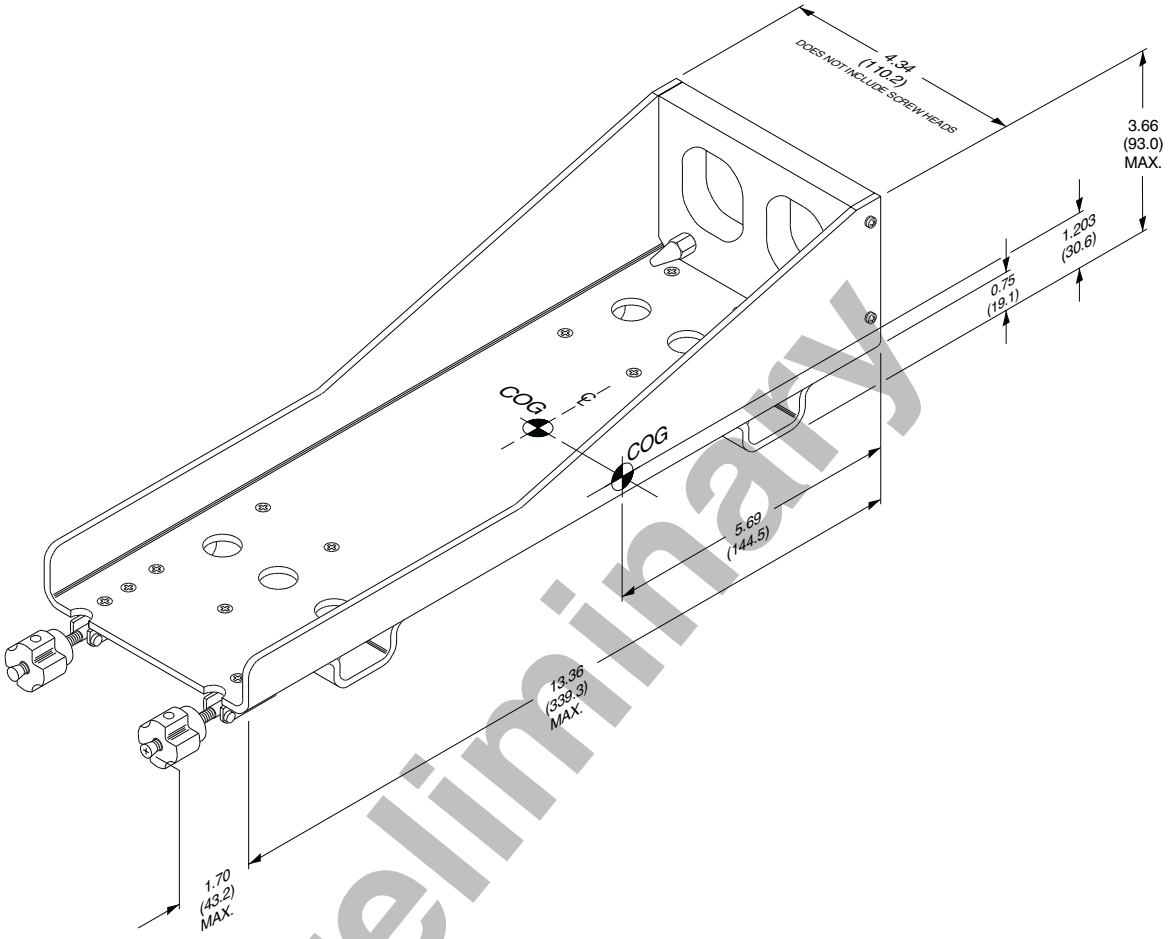
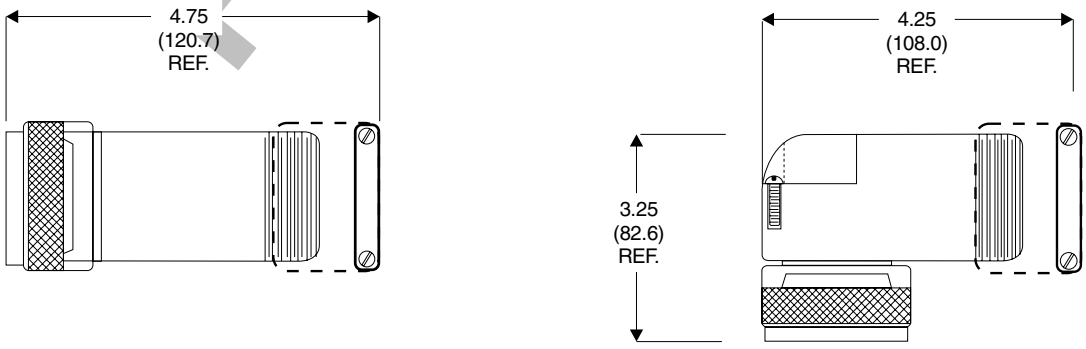


Figure 1-4. Ruggedized TRC Mounting Tray (P/N 805-10870-003)

NOTE
DIMENSIONS ARE IN INCHES (MILLIMETERS)



STRAIGHT
BACKSHELL
P/N 613-10042-001

SPLIT ELBOW
90° BACKSHELL
P/N 613-10043-001

Figure 1-5. P1 Connector Dimensions (Reference Only)

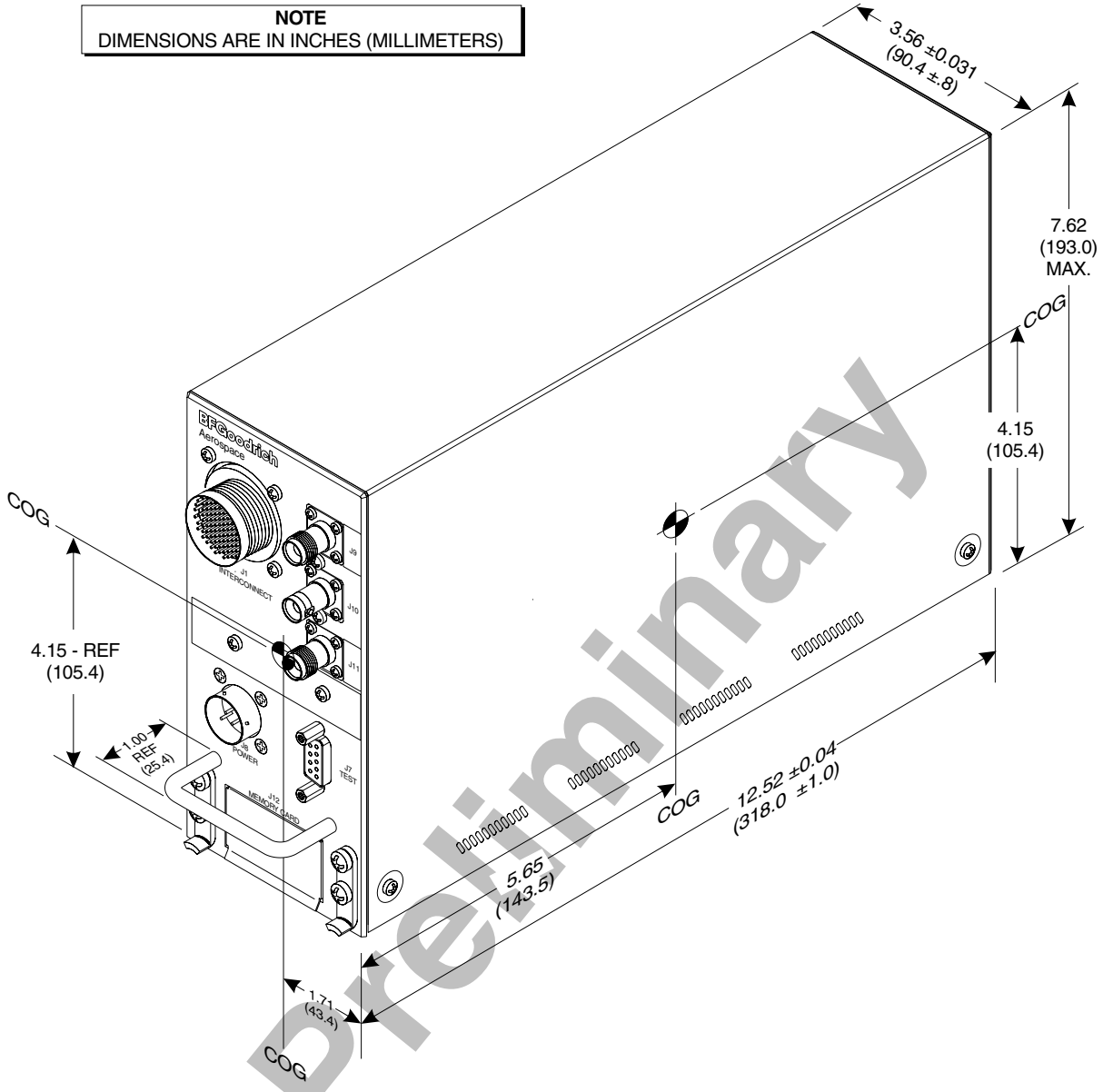


Figure 1-6. TRC899 Transmitter Receiver Computer (TRC)

1.3.2 System Configuration Module P/N 814-18005-001

The system configuration module is used to store aircraft installation dependent information via the service menu. The system configuration is read from the module during turn-on. The module is included in the installation kit and is designed to be installed inside the backshell of connector P1.

1.3.3 Display (Alternate or WX-1000/SKY497 Display P/N 78-8060-5900-x)

The display used is installation dependent. If installing to meet the requirements for a TCAS I installation an alternate display device (i.e., EFIS, MFD, IVSI, weather radar indicator) approved for displaying TCAS I information is required. If installing to meet requirements for a TAS installation an alternate display device, the WX-1000/SKY497 display, or both can be used as primary means for displaying traffic information.

When interfaced to both displays (alternate display and WX-1000/SKY497 display), display functions can be linked together or separate depending on the capabilities of the alternate display. When installed with an alternate display device only, the service menu cannot be accessed via the display, therefore a terminal device (i.e., laptop) is required for system setup and post-installation checkout (see appendix F). If both displays are connected the service menu can be accessed by the WX-1000/SKY497 display only.

The SKY899 is designed to transmit traffic information to the alternate display device via our ARINC-429 bus interface (100 kHz fixed speed). Refer to display manufacturer instructions for installation details.

WX-1000/SKY497 Display P/N 78-8060-5900-x. To operate with SKYWATCH HP, existing WX-1000 displays must conform to TSO-C113. If the equipment tag on the back of the unit (see figure 1-7) does not identify SKYWATCH and TSO-C113, return the display to the factory for modification. To schedule workload and ensure a quick turn around, a return authorization will be required. Call BFG Avionics Systems Customer Service (1-800-453-0288 or 1-616-949-6600) for details.

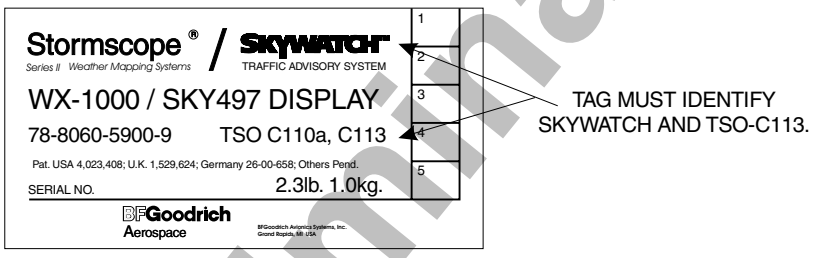


Figure 1-7. WX-1000/SKY497 Display Equipment Tag

The display unit mounts in a standard 3ATI panel cutout. All connections to the display are made through a single 25-position male D-subminiature connector on the back panel. Figure 1-8 depicts the indicator dimensions. The last digit of the part number identifies the different versions (refer to para 1.4.2). Table 1-3 lists the contents of an installation kit supplied with each unit.

Table 1-3. WX-1000/SKY497 Display Installation Kit P/N 817-10802-001

QUANTITY	PART NUMBER	DESCRIPTION
4	26-1001-6374-5	Screw, Machine, 6-32 x 3/4 in. Phillips Pan Head, Black Oxide
1	26-1003-5633	Connector, 25 Position Recpt. Shell
1	26-1006-2426-6	Connector Backshell, DB25
2	26-1006-1089-3	Connector Lock Post Assembly
25	26-1003-4274-9	Connector Socket, Screw Machine (M39029/63-368)

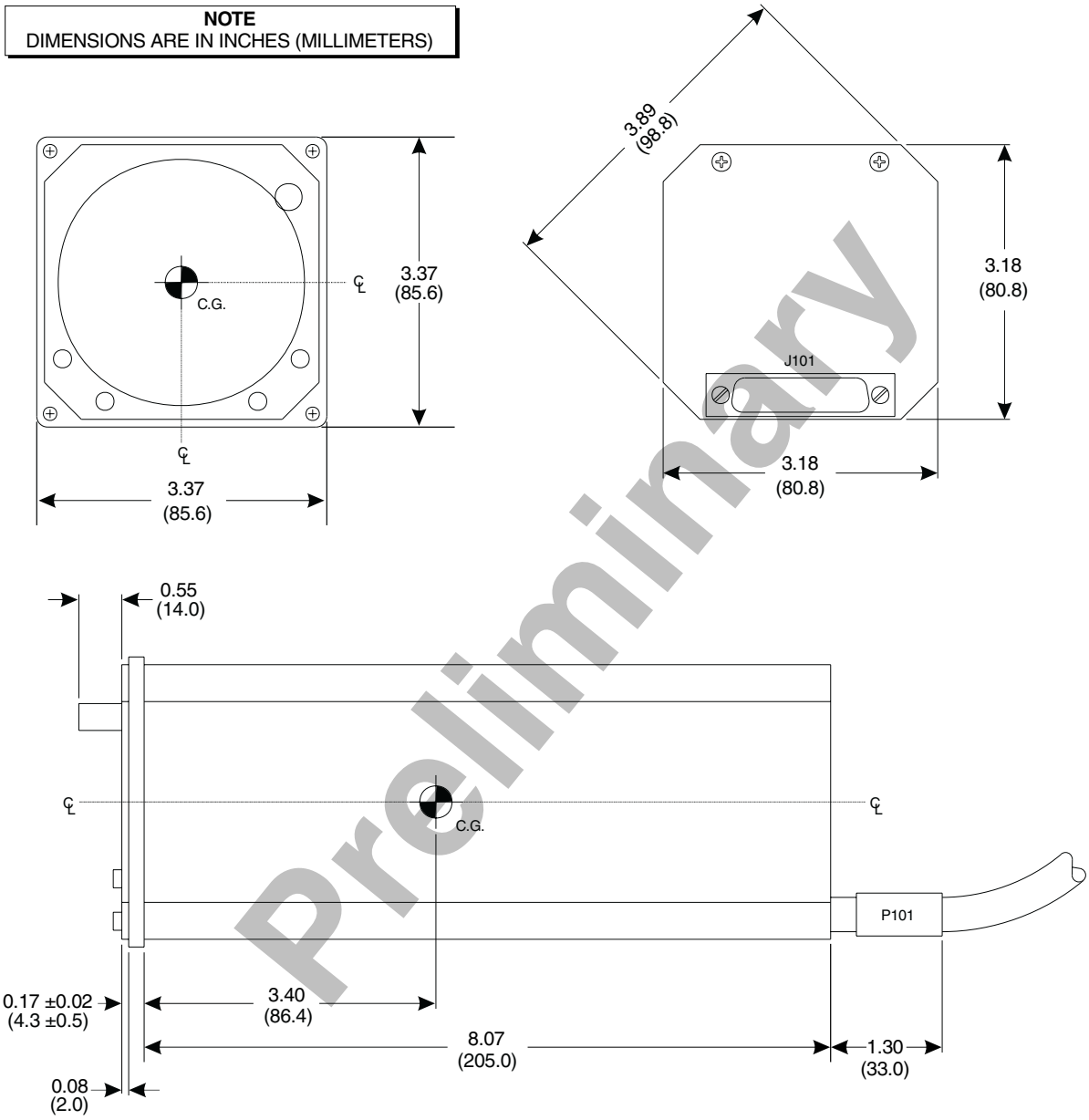


Figure 1-8. WX-1000/SKY497 Display

1.3.4 Directional Antenna (NY156 P/N 805-10003-001 or NY164 P/N 805-10890-001)

The directional antenna is a teardrop-shaped antenna. Connections are made through two TNC and one BNC connector. The antenna is sealed against environmental extremes and is non-repairable. To ensure a tight seal between the airframe and antenna, an O-ring seal (i.e., an O-ring groove for an MS28775-044 O-ring) has been incorporated into the design. An O-ring is supplied with each antenna and must be installed when mounting the antenna.

To fit specific airframes, a special adapter plate is also required. The adapter plate is included in the installation kit shipped with each system. Refer to table 1-4 for a list of installation kits associated with various airframes. For aircraft not listed, contact the aircraft manufacturer for information relative to the radius of the area where the antenna is to be mounted. Table 1-5 lists the contents of each installation kit. The installation kits differ only in the size of the special airframe adapter plate. Figure 1-9 depicts the antenna dimensions.

Table 1-4. Airframe Installation Kits

MANUFACTURER	AIRFRAME	INSTALLATION KIT PART NUMBER
AEROSPATIALE	ATR-42	817-10009-001
AGUSTA	A109	817-10009-006
BAE/RAYTHEON	HAWKER 400, 600, 700, 800, and 1000	817-10009-004
BEECH	BEECHJET, KING AIR 90, 100, 200, 300, and 350 BARON 33, 35, 36, 55, 58, BE-99, 1300, & 1900C/D	817-10009-001 817-10009-002
BELL	206, 407, 427	817-10009-006
CANADAIR	CHALLENGER 600 and 601	817-10009-005
CESSNA	CITATION III, VI, VII CITATIONJET, CITATION I, II, V 182, 210, 337, 401, 414, 425, 441	817-10009-001 817-10009-004 817-10009-006
COMMANDER	114	817-10009-006
DASSAULT	FALCON 10, 20, 50 FALCON 900	817-10009-001 817-10009-005
DEHAVILLAND	Dash 7/8	817-10009-001
EMBREAR	EMB 110, 120	817-10009-001
EUROCOPTER	EC135	817-10009-006
FAIRCHILD	METROLINER, METROLINER III, MERLIN	817-10009-001
FOKKER	F28	817-10009-003
GULFSTREAM	G-I, G-II, and G-III	817-10009-001
IAI	WESTWIND 1125	817-10009-001
LEARJET	LEARJET 31, 35, 36, 55, and 60	817-10009-004
MITSUBISHI	MU-2	817-10009-002
MOONEY	M20	817-10009-006
PILATIS	PC-12	817-10009-001
PIPER	CHEYENNE 400LS NAVAJO MIRAGE, MALIBU SARATOGA, SENECA	817-10009-001 817-10009-002 817-10009-005 817-10009-006
SAAB	SF-340	817-10009-001
SABRELINER	SABRE 65	817-10009-001
SHORTS	360	817-10009-001
SIKORSKY	S-76	817-10009-006
SOCATA	TBM-700 TB20	817-10009-001 817-10009-006

Table 1-5. Directional Antenna Installation Kit 817-10009-xxx

KIT PART NUMBER	SUPPLIED PARTS *		
	PART NUMBER	DESCRIPTION	QUANTITY
817-10009-001	800-10066-001	Special Adapter Plate, 40 Inch (101.6 cm) Radius	1
817-10009-002	800-10066-002	Special Adapter Plate, 63 Inch (160.0 cm) Radius	1
817-10009-003	800-10066-004	Special Adapter Plate, 80 Inch (203.2 cm) Radius	1
817-10009-004	800-10066-003	Special Adapter Plate, 32 Inch (81.3 cm) Radius	1
817-10009-005	800-10066-005	Special Adapter Plate, 47 Inch (119.4 cm) Radius	1
817-10009-006 (No Adapter Plate)	100-10022-001*	Screw, 10-32 x 1 PPH SS (MS51958-67)	4
	101-10027-001*	Stop Nut, 10-32 (MS21044C3)	4

* Hardware supplied with all kits.

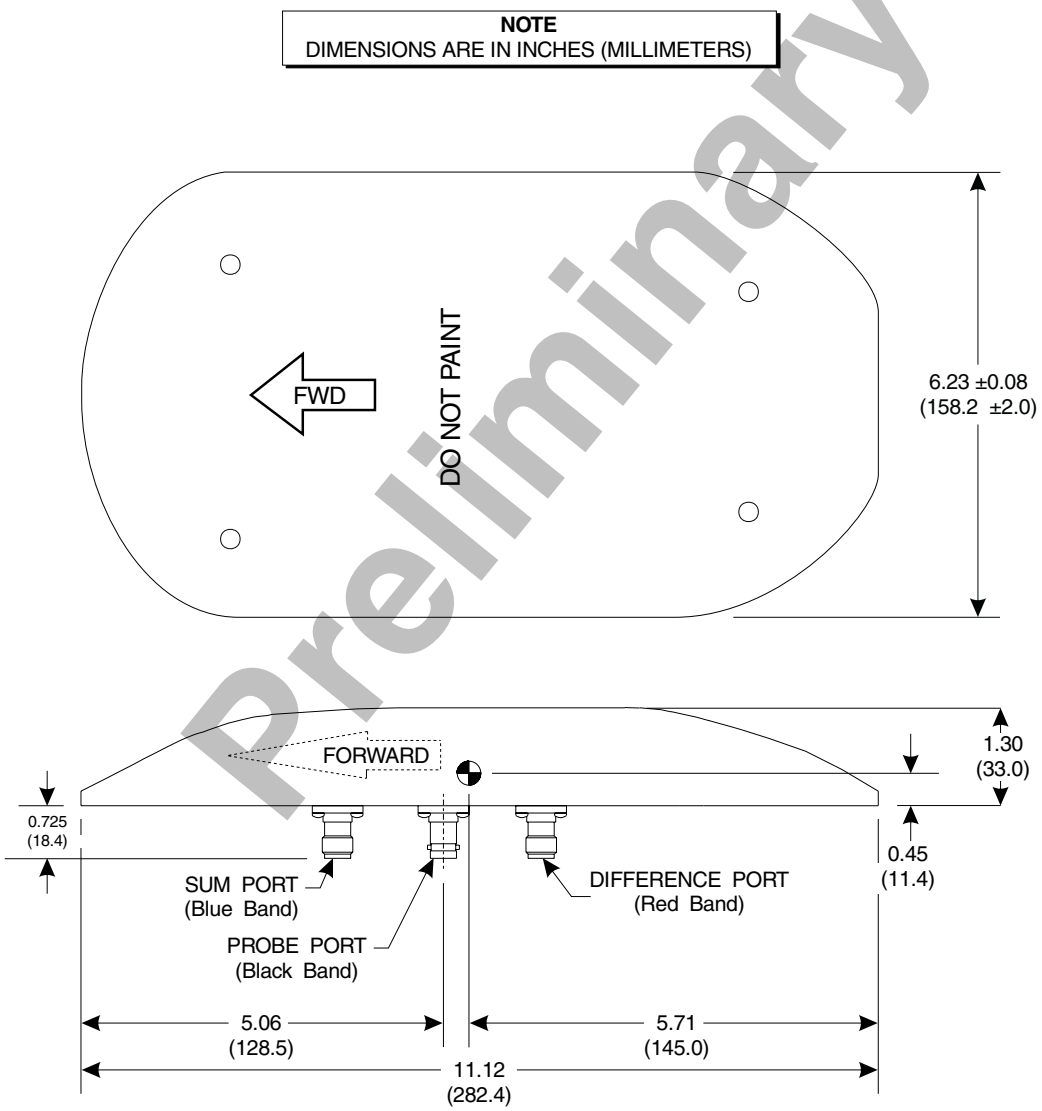


Figure 1-9. NY156/NY164 Directional Antenna

1.4 SPECIFICATIONS

1.4.1 Transmitter Receiver Computer (TRC)

PART NUMBER:	805-11900-001 - TRC899
SIZE:	Approximately 12.52 inches (31.90 cm) Deep Approximately 3.56 inches (9.04 cm) Wide Approximately 7.62 inches (19.36 cm) High
WEIGHT:	Approximately 8.88 lb (4.03 kg) Not Including Mounting Tray Approximately 9.76 lb (4.43 kg) With Standard Mounting Tray Approximately 10.89 lb (4.94 kg) With Ruggedized Mounting Tray
OPERATING TEMPERATURE:	-55 to +70 degrees Celsius (-67 to +158 degrees Fahrenheit)
STORAGE TEMPERATURE:	-55 to +85 degrees Celsius (-67 to +185 degrees Fahrenheit)
OPERATING ALTITUDE:	55,000 feet (Maximum)
COOLING:	Conduction and Forced Air (Internal Fan) Convection
POWER REQUIREMENTS:	18 to 32 V dc, 2 Amps @ + 28 V dc(Maximum)
TRACKING CAPABILITY:	Up to 35 intruder aircraft (displays only the 8 highest priority aircraft)
SURVEILLANCE RANGE:	Horizontal tracking radius: 35 nmi Maximum ATCRBS Surveillance 50 nmi Maximum ADS-B Surveillance Relative altitude tracking range: ±10,000 ft maximum
DISPLAY RANGES:	Horizontal display ranges: 2, 6 & 15 nmi (WX-1000/SKY497 Display) Relative altitude display ranges: ±2,700 ft (normal mode) +9,000 ft to -2,700 ft (above mode/look up) +2,700 ft to -9,000 ft (below mode/look down) +9,900 ft to -9,900 ft (unrestricted)
RANGE ACCURACY:	± 0.05 nmi (Typical)
BEARING ACCURACY:	With NY156 Antenna - 5° RMS (Typical) 30° Peak Error With NY164 Antenna - 7° RMS (Typical) 30° Peak Error
ALTITUDE ACCURACY:	±200 ft
CERTIFICATION: *	USA (FAA) TSO C118 (TCAS I) & C147 (TAS) Refer to FSAW 98-04B for Flight Standards Service policy concerning follow-on field approvals.
RTCA COMPLIANCE:	Software DO178-B Level D DO-160D Category F2XBAB[(SBM)(UG)]XXXXXXZBABARRLXXXXXXA

* Listed are current certifications at time of publication, contact Field Service Engineering at 1-800-453-0288 or 1-616-949-6600 for latest certification information.

1.4.2 WX-1000/SKY497 Display

PART NUMBER DEFINITION:
78-8060-5900-8 (Black Bezel)
78-8060-5900-9 (Gray Bezel)

SIZE:
Height: 3.37 inches (8.56 cm)
Width: 3.37 inches (8.56 cm)
Depth: 8.24 inches (20.92 cm)

WEIGHT:
2.3 lb (1.0 kg)

OPERATING TEMPERATURE:
-20 to +55 degrees Celsius (-4 to +131 degrees Fahrenheit)

STORAGE TEMPERATURE:
-55 to +70 degrees Celsius (-67 to +158 degrees Fahrenheit)

OPERATING ALTITUDE:
55,000 feet (Maximum)

TSO COMPLIANCE:
C110a & C113

RTCA COMPLIANCE:
DO-160C F1-CA(NBM)XXXXXXZXXXZUAXXXXXX

POWER REQUIREMENTS:
+15/-15 V dc, 0.7 A (Maximum)

1.4.3 Directional Antenna

PART NUMBER:	805-10003-001 (NY156) 805-10890-001 (NY164)
SIZE:	1.3 inches (3.25 cm) high 6.23 in (15.82 cm) wide 11.12 in (27.94 cm) deep
WEIGHT:	2.3 lb (1.04 kg)
SPEED:	Rated to 600 knots (0.9 Mach) @ 25,000 feet.
FREQUENCY:	1030-1090 MHz
TSO CATEGORY:	C118
ENVIRONMENTAL CATEGORY:	DO-160C F2-AC(CLM)XSFDFSXXXXXXXL(2A)X
FINISH:	Gloss white Skydrol resistant polyurethane paint

1.5 MODIFICATIONS & SOFTWARE REVISIONS

Modifications (MODS) and software revisions for the TRC899 are identified by an entry on the S/N & I.D. tag. The system software revision is a collective designator for all software/firmware installed within the TRC899. SKY HP software version can be verified via the service menu. Hardware modifications and software versions are listed below.

Hardware Modifications - None at the time of publication.

Table 1-6. TRC899 Software Revisions

SYSTEM REVISION	SKY HP VERSION	DESCRIPTION
1.00	1.00	Original production release.

1.6 INTERFACE

The electrical characteristics of all input and output signals are detailed in Appendix A. Listed below in table 1-7 is the minimum equipment required to interface with the SKY899. See chapter 2 for details.

Table 1-7. Minimum Interface Equipment Required

	AVIONICS EQUIPMENT										
SURVEILLANCE MODE	MAGNETIC HEADING	BAROMETRIC ALTITUDE	RADIO ALTITUDE	GPS NAV	LANDING GEAR SWITCH	SQUAT SWITCH (WOW)	SUPPRESSION BUS	AUDIO INHIBIT (GPWS)	EXTERNAL LAMPS	PILOT CONTROLS (PUSHBUTTONS)	AUDIO SYSTEMS
ATCRBS (Active Only)	①	X	①		①	X	X	②	③	③	X
ATCRBS & ADS-B	X	X	①	X	①	X	X	②	③	③	X

X Required.
① Optional but will enhance performance. (See paragraphs 2.7 thru 2.23 for details.)
② Required if Terrain Warning System (GPWS) is installed.
③ Only if Alternate Display requires it, see display manufacturer's instructions.

1.7 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Antenna Cables

The installer will supply all antenna cables and connectors. The directional antenna requires three cable assemblies; sum (Sigma Port), bit probe (Probe Port) and difference (Delta Port). Cable attenuation for the sum and difference ports must not exceed 2.5 dB. Table 1-8 identifies U. S. vendors who sell approved cables by the foot. Table 1-9 provides a cable to connector cross-reference.

RG142B or equivalent may be used for the bit probe cable. Attenuation for the bit probe cable must not exceed 6 dB.

NOTE

Use of any cable not meeting BFGoodrich Avionics Systems specifications voids all system warranties.

Table 1-8. Directional Antenna SIGMA and DELTA Port Cable Vendors

Electrical & Mechanical Technologies (EMTEQ) 1-888-679-6170 262-679-6170 FAX 262-679-6175				
Part Number	**Attenuation (dB/100 ft 1.0 gHz)**	**Weight (lb) (per 100 ft)**	**Maximum Length (ft)**	**Minimum Bend Radius (in)**
PFLX195-100	10.81	2.7	21.8	0.50
PFLX240-100	9.76	4.5	25.0	0.75
PFLX340-100	6.3	7.2	38.2	0.88
Electronic Cable Specialists 1-800-327-9473 414-421-5300 FAX 414-421-5301				
Part Number	**Attenuation (dB/100 ft 1.0 gHz)**	**Weight (lb) (per 100 ft)**	**Maximum Length (ft)**	**Minimum Bend Radius (in)**
352001	12.2	2.7	15	0.81
311601	8.7	5.5	26	1.15
311201	5.56	8.5	41	1.59
310801	3.63	16.1	63	2.26
PIC Wire and Cable 1-800-742-3191 262-246-0500 FAX 262-246-0450				
Part Number	**Attenuation (dB/100 ft 1.0 gHz)**	**Weight (lb) (per 100 ft)**	**Maximum Length (ft)**	**Minimum Bend Radius (in)**
S33141	7.2	6.5	32	1.5
S55122	5.7	8.2	40	1.6
S22089	3.8	18	61	2.5

If cable weight is not a consideration, select lowest loss cable. Contact cable vendors before installation. New low-loss light-weight cables may be available.

Table 1-9. Cable to Connector Reference

Electrical & Mechanical Technologies (EMTEQ) 1-888-679-6170 262-679-6170 FAX 262-679-6175				
Cable Part Number	**TNC Straight**	**TNC Right Angle**	**BNC Straight**	**BNC Right Angle**
PFLX195-100	TMS195-1	TMR195-1	BMS195-1	BMR195-1
PFLX240-100	TMS240-1	TMR240-1	BMS240-1	BMR240-1
PFLX340-100	TMS340-1	TMR340-1	BMS340-1	BMR340-1
Electronic Cable Specialists 1-800-327-9473 414-421-5300 FAX 414-421-5301				
Cable Part Number	**TNC Straight**	**TNC Right Angle**	**BNC Straight**	**BNC Right Angle**
311601	CTS922	CTR922	CBS922	CBR922
311201	CTS122	CTR122	CBS122	CBR122
310801	CTS022	CTR022	CBS022	CBR022
352001	CTS3522	CTR3522	CBS3522	CBR3522
PIC Wire and Cable 1-800-742-3191 262-246-0500 FAX 262-246-0450				
Cable Part Number	**TNC Straight**	**TNC Right Angle**	**BNC Straight**	**BNC Right Angle**
S33141	190308	190309	190312	190313
S55122	190608	190609	190612	190613
S22089	190408	190409	190412	190413

Antenna Sealant — For pressurized aircraft, use a sealant that meets the requirements of SAE AMS-S-8802 such as Flamemaster® CS3204 class B. For non-pressurized aircraft, use a non-corrosive sealant that meets the *physical* requirements of MIL-A-46146 such as General Electric RTV162.

Circuit Breaker — 5 Amp

Connector Installation

Antenna Cables — See table 1-8.
Tool M22520/5-01
Die M22520/5-19 (EMTEQ Cable PFLX195-100)
Die M22520/5-43 (EMTEQ Cable PFLX240-100)
Die M22520/5-35 (EMTEQ Cable PFLX340-100)
Die M22520/5-19 (ECS Cable 311601)
Die M22520/5-61 (ECS Cable 311201)
Die M22520/5-21 (ECS Cable 310801)
Die 190318 (PIC Cable S33141)
Die 190418 (PIC Cable S22089)
Die 190618 (PIC Cable S55122)

P1 Interconnect — Crimping Tool M22520/2-01
Positioner M22520/2-07
Insertion MS27495 A22M
Removal MS27495 R22M

Connector Installation (Continued)

P8	Power	Crimping Tool M22520/1-01 Positioner M22520/1-02 Insertion MS24256A16 Removal MS24356R16
P101	Display	Crimping Tool M22520/2-01 Positioner M22520/2-08 Insertion/Removal M81969/1-02

Data Cables

RS-232, RS-422, and ARINC-429 data cables are #22 AWG (minimum) twisted, shielded cables.

Flightline Tester

Either the BFG TT391 Flightline Tester, IFR Systems TCAS-201 (with TCAS I firmware) Ramp Test Set (Appendix C), or TIC T-49C Flightline Tester (Appendix D). The test set is required to do the post installation checkout.

Heading Input Cable

This cable provides aircraft heading information to the SKY899. Cable that meets the specification for SKY899 installation is available from suppliers listed in table 1-10.

Table 1-10. Heading Input Cable Vendors

US COMPANY	CABLE P/N
Dallas Avionics 1-800-527-2581 214-320-9776 FAX 214-320-1057	WX-5 (6.84 lb/ 100 ft)
Electronic Cable Specialists 1-800-327-9473 414-421-5300 FAX 414-521-5301	3N6607 (7.5 lb/ 100 ft)
A.E. Petsche 817-461-9473 FAX 817-277-2887	TZGYR (6.84 lb/ 100 ft)
EDMO Distributors 1-800-235-3300 805-295-6689 FAX 1-800-828-0623 FAX 805-295-6703	WX-1000 SYNCHRO
PIC Wire and Cable 1-800-742-3191 262-246-0500 FAX 262-246-0450	WM25807 (7.2 lb/ 100 ft)

Lamps (external annunciators)

External annunciators are required when using an alternate display that is not capable of displaying above and below vertical modes. Lamp outputs are switched to ground when active (LP1OUT & LP2OUT). Lamps should be labeled ABV and BLW. An optional operation mode lamp can be installed to show system has been switched from standby into operation mode. Refer to paragraph 2.14, 2.15 and A.2. Lamps can be 12V or 28V with maximum current 300 mA

Miscellaneous Hardware	The installer must provide suitable hardware to attach the TRC Mounting Tray. The following stainless steel fasteners are recommended: Channel Mount: Four 8-32 UNC-2A pan head machine screws per ANSI B18.6.3. (Six are required for the ruggedized tray.) or Four 8-32 UNC-2A hex socket cap machine screws per ANSI/ASME B18.3. (Six are required for the ruggedized tray.) Four No. 8 helical spring lockwasher per ANSI/ASME B18.21.1. (Six are required for the ruggedized tray.) Flat Mount: Eight 6-32 UNC-2A 100 degree flat head machine screws per B18.6.3.
Oscilloscope	Required to verify SKY899 suppression pulse (100 µs ±5µs, +28 V dc).
Power Cable	For the power cable, use #16 AWG (minimum) twisted shielded pair cable (Beldon 83322, Alpha 2826/2, or equivalent).
RS-232 Terminal Device (e.g., Laptop Computer)	Required if using an alternate display, (see Appendix E for instructions). Terminal device is used for system setup, post installation checkout and troubleshooting. Any computer, with RS-232 terminal emulation software (e.g., Procomm®, HyperTerminal, etc.) may be used as the terminal device. A standard 9-pin serial cable is required.
Surface Preparation	Alodine® No. 1001 required for installation of the antenna.
Switches	If an alternate display is used a separate ON/OFF switch is required. Any general purpose SPDT toggle switch (3 A @ 28 V dc) may be used. If the final configuration includes a WX-1000 *Stormscope* Weather Mapping System, two external switches will be required. A SPST switch will be required for the SKYWATCH/*Stormscope* display mode switch (SW1). A DPDT switch will be required for the WX-1000 maintenance switch (SW2). Any general purpose toggle switch (3 A @ 28 V dc) may be used.
WX-1000/SKY497 Display & WX-1000 Processor Cable	This cable is used to connect the WX-1000/SKY497 display and/or WX-1000 processor to the TRC. Required connectors and contact pins are supplied in the installation kit. Cable specifications and U.S. vendors are listed below in table 1-11.

NOTE

Use of any cable not meeting BFG Avionics Systems specifications voids all system warranties.

Table 1-11. Display Cable Vendors

U.S. COMPANY	DISPLAY CABLE P/N	WEIGHT (LB PER 100 FT)
Dallas Avionics 1-800-527-2581 214-320-9776 FAX 214-320-1057	WX-3	10.5
Electronic Cable Specialists 1-800-327-9473 414-421-5300 FAX 414-421-5301	3N6715	16
A.E. Petsche 817-461-9473 FAX 817 277 2887	TZDIS	13.1
PIC Wire and Cable 1-800-742-3191 262-246-0500 FAX 262-246-0450	WM25815	14.5
EDMO Distributors 1-800-235-3300 509-535-8280 FAX 1-800-828-0623 FAX 509-535-8266	WX-1000 Display	---

1.8 INSTALLATION APPROVAL

The SKY899 must be treated as a major alteration on F.A.A. form 337, if not installed under a type certificate or supplemental type certificate. Aircraft mandated for TCAS I (i.e., part 91 & 135), must be installed under a type certificate or supplemental type certificate, refer to FSAW 98-04B. Application for approval may be made at any F.A.A. Flight Standards District Office.

1.9 WARRANTY INFORMATION

The SKY899 Traffic Alert/Advisory System is warranted for two years from the date of installation (not to exceed 30 months from the date of shipment from BFGoodrich Avionics Systems) subject to the following limitations.

1.9.1 Warranty Statement

BFGoodrich Avionics Systems, (hereinafter called BFGAS), warrants each item of new equipment manufactured or sold by BFGAS to be free from defects in material and workmanship, under normal use as intended, for a period of 30 months from date of shipment by BFGAS to an authorized facility, or 24 months from date of installation by an authorized facility, whichever occurs first. No claim for breach of warranties will be allowed unless BFGAS is notified thereof, in writing, within thirty (30) days after the material or workmanship defect is found.

The obligation of BFGAS shall be limited to replacing or repairing at its factory the equipment found defective under terms of this warranty certificate; providing that such equipment is returned in an approved shipping container, transportation charges prepaid, to BFGAS, Grand Rapids, Michigan, or such other location as BFGAS may authorize. BFGAS reserves the right to have necessary repairs performed by an authorized agency.

This warranty shall not apply to any unit or part thereof which has not been installed or maintained in accordance with BFGAS instructions, or has been repaired or altered in any way so as to adversely affect its performance or reliability, or which has been subjected to misuse, negligence or accident.

This warranty is exclusive and is accepted by buyer in lieu of all other guaranties or warranties express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. Buyer agrees that in no event will BFGAS liability for all losses from any cause, whether based in contract, negligence, strict liability, other tort or otherwise, exceed buyer's net purchase price, nor will BFGAS be liable for any special, incidental, consequential, or exemplary damages.

BFGAS reserves the right to make changes in design or additions to or improvements in its equipment without the obligation to install such additions or improvement in equipment theretofore manufactured.

1.9.2 Related Policies and Procedures

1. If the original registered owner of a SKY899 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 Avionics Systems
   5353 52nd Street, S.E.
   Grand Rapids, MI USA 49512

2. Equipment must be installed by a BFG Avionics Systems 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 Avionics Systems or a designated BFG Avionics Systems Service Agency within the specified warranty period.
4. A product which is defective in workmanship and/or material shall be returned to BFG Avionics Systems 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 Avionics Systems 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.
5. BFG Avionics Systems is in no way obligated or responsible for supporting or participating in the costs of the installation warranty. The entire responsibility lies with the BFG Avionics Systems Authorized Dealer making the installation. BFG Avionics Systems is only responsible for the product warranties outlined in paragraph 1.9.1.
6. BFG Avionics Systems cannot authorize warranty credit for troubleshooting of other systems in the aircraft in order to reduce noise interference with the SKY899 system.

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CHAPTER 2
INSTALLATION

2.1 INTRODUCTION

The information and instructions provided in this section are directed toward fixed-wing aircraft. The complex nature of rotorcraft installations (e.g., antenna placement; composite versus metal blades, available ground plane, rotor mast interference, strike kits, etc.) requires that each installation be evaluated on a case-by-case basis. Before starting a rotorcraft installation, contact Field Service Engineering at 1-800-453-0288 or 1-616-949-6600.

NOTE

Tolerances (unless otherwise indicated):

ANGLES ARE	± 1°
.00 TWO PLACE DECIMALS ARE	± .02
.000 THREE PLACE DECIMALS ARE	± .010

Installation must be made by qualified personnel, in conformance with applicable government regulations. This information furnished is for convenience only.

NOTES

1. The conditions and test required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if the installation is performed in accordance with Part 43 or the applicable airworthiness requirements.
2. Installation instructions for the WX-1000 processor are detailed in the WX-1000 Installation Manual.

2.2 UNPACKING, INSPECTION AND STORAGE

CAUTION

The display and TRC are sensitive to electrostatic discharge (ESD) and may be damaged if not handled correctly. Do not remove protective covers from electrical connectors during unpacking. Touching an exposed connector may cause electrostatic damage to equipment.

Carefully unpack the system and note any damage to shipping containers or equipment. Visually inspect each component for evidence of damage. Compare the equipment received with that noted on the packing list. Immediately report any missing items or evidence of damage to the carrier making the delivery. To justify a claim, retain the original shipping container and all packing materials.

Every effort should be made to retain the original shipping containers for storage. If the original containers are not available, a separate cardboard container should be prepared that is large enough to accommodate sufficient packing material to prevent movement. The ambient temperature of the storage area should not fall below -55 °C (-67 °F) or rise above 85 °C (185 °F).

2.3 ANTENNA LOCATION

Location is an important factor for maximum antenna performance. Optimum location for a particular aircraft type is usually available from the aircraft manufacturer. In selecting a location, consider the following:

Directional Antenna

The mounting site should be on the top forward fuselage, as close to the centerline as possible, and within -10° of the in-flight horizon (see figure 2-1). The optimum mounting point for maximum coverage is as far forward as possible without exceeding the -10° forward pitch. If necessary, consideration should be given to relocating other antennas to obtain the furthest forward location for the directional antenna. The antenna should be mounted on the aircraft with at least 20 dB isolation (about 30 inches (76.2 cm)) from other L-band frequency antennas and 24 inches (61.0 cm) from other antennas or obstructions. The ground-plane should be as large as possible, a 30-inch (76.2 cm) ground-plane diameter is recommended.

The directional antenna can be bottom mounted only if a suitable top mount location is not available. Each bottom mount installation must be evaluated on a case-by-case basis. Before starting a bottom mount installation, contact Field Service Engineering at 1-800-453-0288 or 1-616-949-6600.

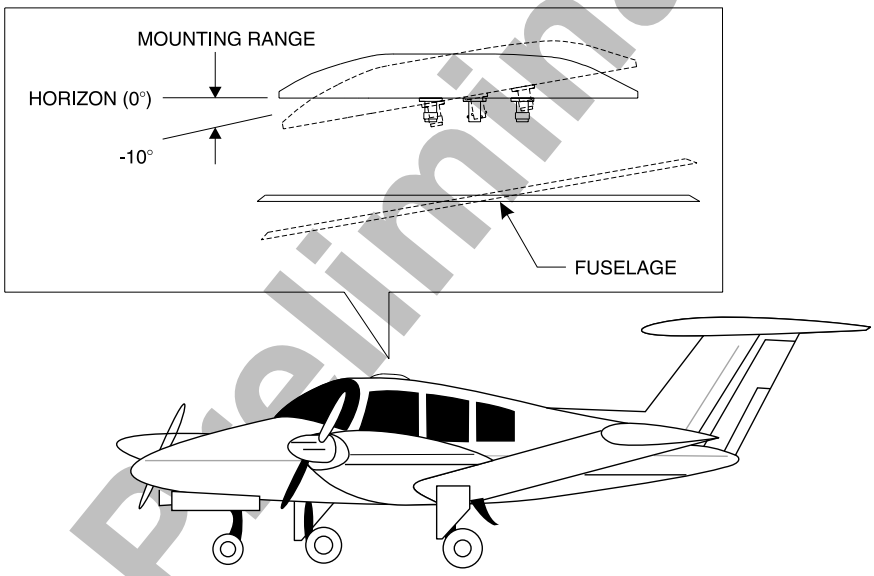


Figure 2-1. Directional Antenna Mounting Location

2.4 TRC LOCATION

Typically the TRC is installed in the electronics bay. In selecting a location, consider the following:

Cable Length

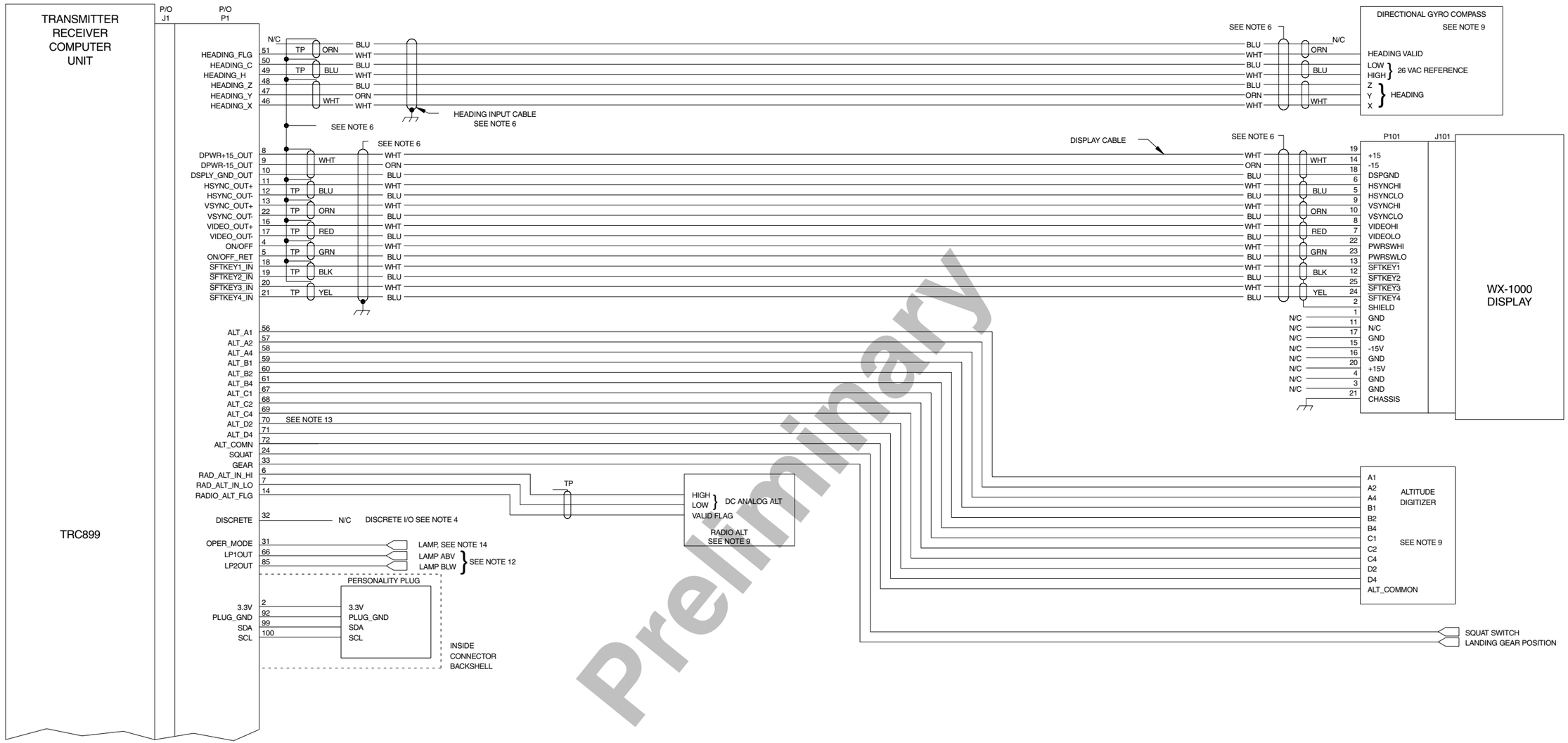
Cable runs should be as short as practicable in order to minimize potential electrical interference. Cable length to antennas must not exceed the values listed in table 1-6.

Cooling

While the TRC has no special cooling requirements, it should be mounted to permit adequate ventilation. Caution should be observed to not inhibit airflow from the rear mounted fan. Allow at least three inches (8 cm) of rear clearance.

Pressurized Aircraft

The TRC may mount inside or outside the pressure vessel. The TRC contains no batteries or potentially explosive components and will operate up to 55,000 ft.



NOTES:

1.) ALL WIRES TO BE 22 AWG EXCEPT WHERE NOTED.

2.) TP - USE TWISTED SHIELDED PAIR CABLE. TERMINATE SHIELD TO AIRFRAME GROUND AT SENSOR (OR POWER SOURCE).

3.) THE SUM CABLE WILL HAVE A BLUE BAND AT EACH END. THE DIFFERENCE CABLE WILL HAVE A RED BAND AT EACH END.

4.) FUTURE OPTION.

5.) A RADIO ALTIMETER, AIRDATA COMPUTER, OR OTHER ARINC 429 OUTPUT DEVICE MAY REPLACE ANALOG SENSORS FOR MAGNETIC HEADING, RADIO ALTITUDE, OR BAROMETRIC ALTITUDE.

6.) TIE THE OUTER SHIELD TO THE CONNECTOR BACKSHELL. CONNECTOR BACKSHELL IS CHASSIS GROUND.

7.) REFER TO INSTALLATION INSTRUCTIONS FOR CABLE SELECTION ON ANTENNA CABLES.

8.) USE AUDIO_H FOR 600 OHM AUDIO SYSTEMS. USE AUDIO_L FOR 150 OHM AUDIO SYSTEMS.

9.) DO NOT INSTALL EXTERNAL ISOLATION DIODES.

10.) THESE TWO DEVICES MUST BOTH BE HIGH SPEED OR BOTH BE LOW SPEED.

11.) THESE TWO DEVICES MUST BOTH BE HIGH SPEED OR BOTH BE LOW SPEED.

12.) ONLY USED WITH EXTERNAL DISPLAYS THAT DO NOT ANNUNCIATE ABOVE AND BELOW.

13.) IF D2 IS NOT USED THEN IT IS A "NO CONNECT" (N/C).

14.) OPTIONAL, MAY BE USED TO DRIVE INDICATOR DEPICTING OPERATIONAL MODE.

Figure 2-2. Interconnect Wiring Without WX-1000 (Sheet 1 of 2)

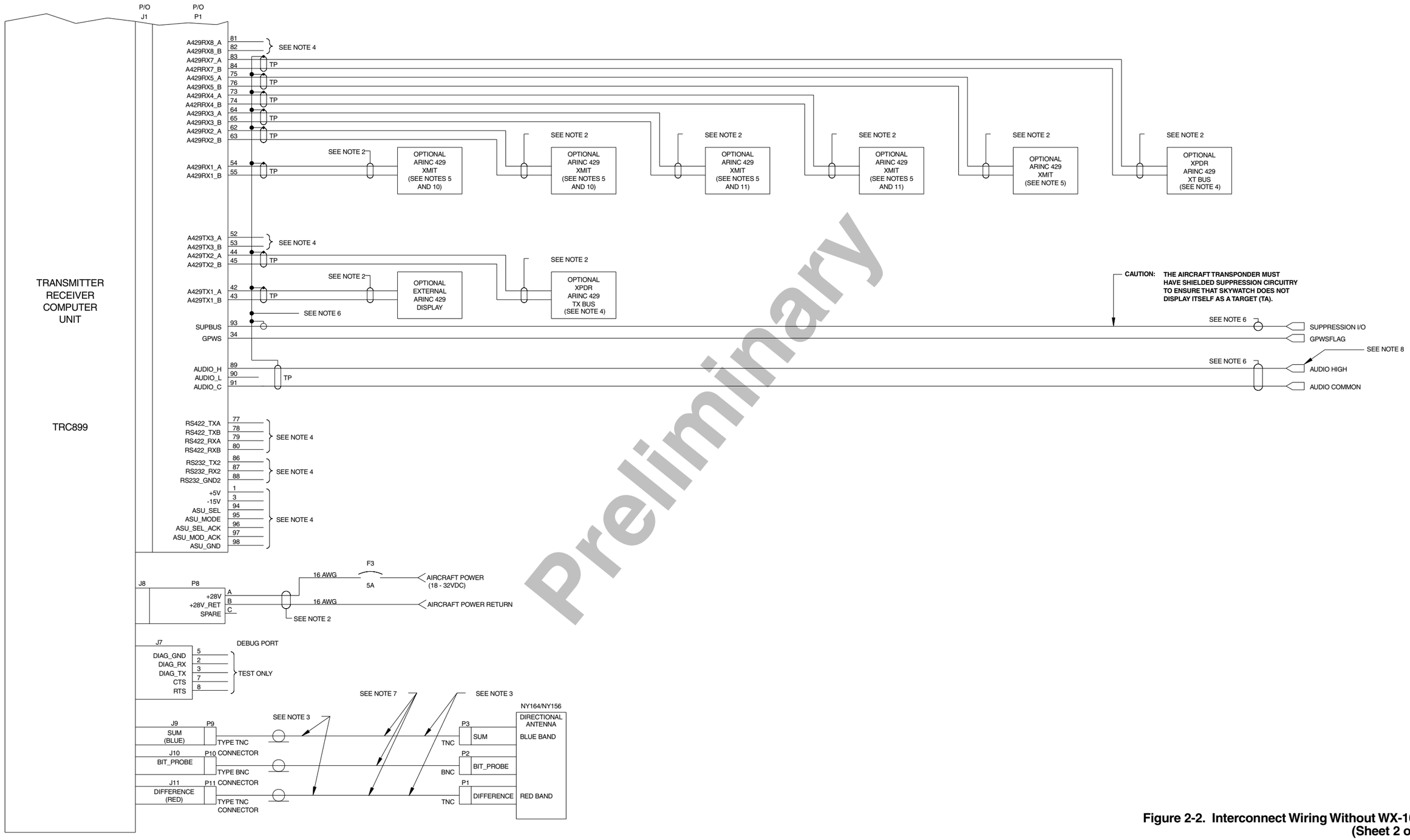
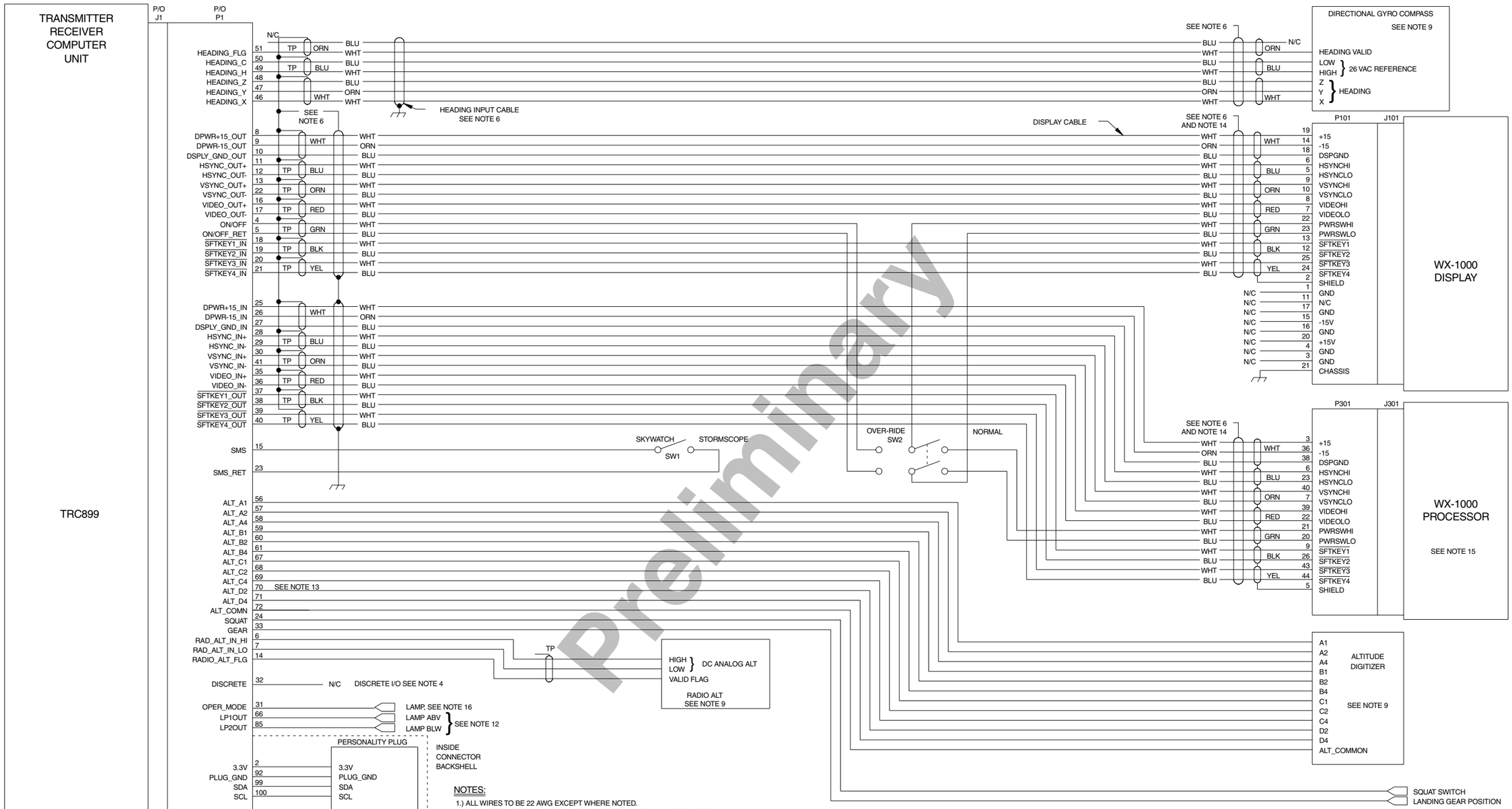


Figure 2-2. Interconnect Wiring Without WX-1000 (Sheet 2 of 2)



NOTES:

1.) ALL WIRES TO BE 22 AWG EXCEPT WHERE NOTED.
2.) TP - USE TWISTED SHIELDED PAIR CABLE. TERMINATE SHIELD TO AIRFRAME GROUND AT SENSOR (OR POWER SOURCE).
3.) THE SUM CABLE WILL HAVE A BLUE BAND AT EACH END. THE DIFFERENCE CABLE WILL HAVE A RED BAND AT EACH END.
4.) FUTURE OPTION.
5.) A RADIO ALTIMETER, AIRDATA COMPUTER, OR OTHER ARINC 429 OUTPUT DEVICE MAY REPLACE ANALOG SENSORS FOR MAGNETIC HEADING, RADIO ALTITUDE, OR BAROMETRIC ALTITUDE.
6.) TIE THE OUTER SHIELD TO THE CONNECTOR BACKSHELL. CONNECTOR BACKSHELL IS CHASSIS GROUND.
7.) REFER TO INSTALLATION INSTRUCTIONS FOR CABLE SELECTION ON ANTENNA CABLES.
8.) USE AUDIO_H FOR 600 OHM AUDIO SYSTEMS. USE AUDIO_L FOR 150 OHM AUDIO SYSTEMS.
9.) DO NOT INSTALL EXTERNAL ISOLATION DIODES.
10.) THESE TWO DEVICES MUST BOTH BE HIGH SPEED OR BOTH BE LOW SPEED.
11.) THESE TWO DEVICES MUST BOTH BE HIGH SPEED OR BOTH BE LOW SPEED.
12.) ONLY USED WITH EXTERNAL DISPLAYS THAT DO NOT ANNUNCIATE ABOVE AND BELOW.
13.) IF D2 IS NOT USED THEN IT IS A "NO CONNECT" (N/C).
14.) IF THE SKYWATCH IS BEING INSTALLED TO AN EXISTING WX-1000 SYSTEM, THE CABLE GROUND AT THE WX-1000 DISPLAY AND THE WX-1000 PROCESSOR MUST BE CHANGED FROM AS SHOWN IN THE WX-1000 MANUAL TO BE AS SHOWN HERE.
15.) INSTALLATION INSTRUCTIONS FOR THE WX-1000 ARE DETAILED IN THE
16.) OPTIONAL, MAY BE USED TO DRIVE INDICATOR DEPICTING OPERATIONAL MODE.

Figure 2-3. Interconnect Wiring With WX-1000 (Sheet 1 of 2)

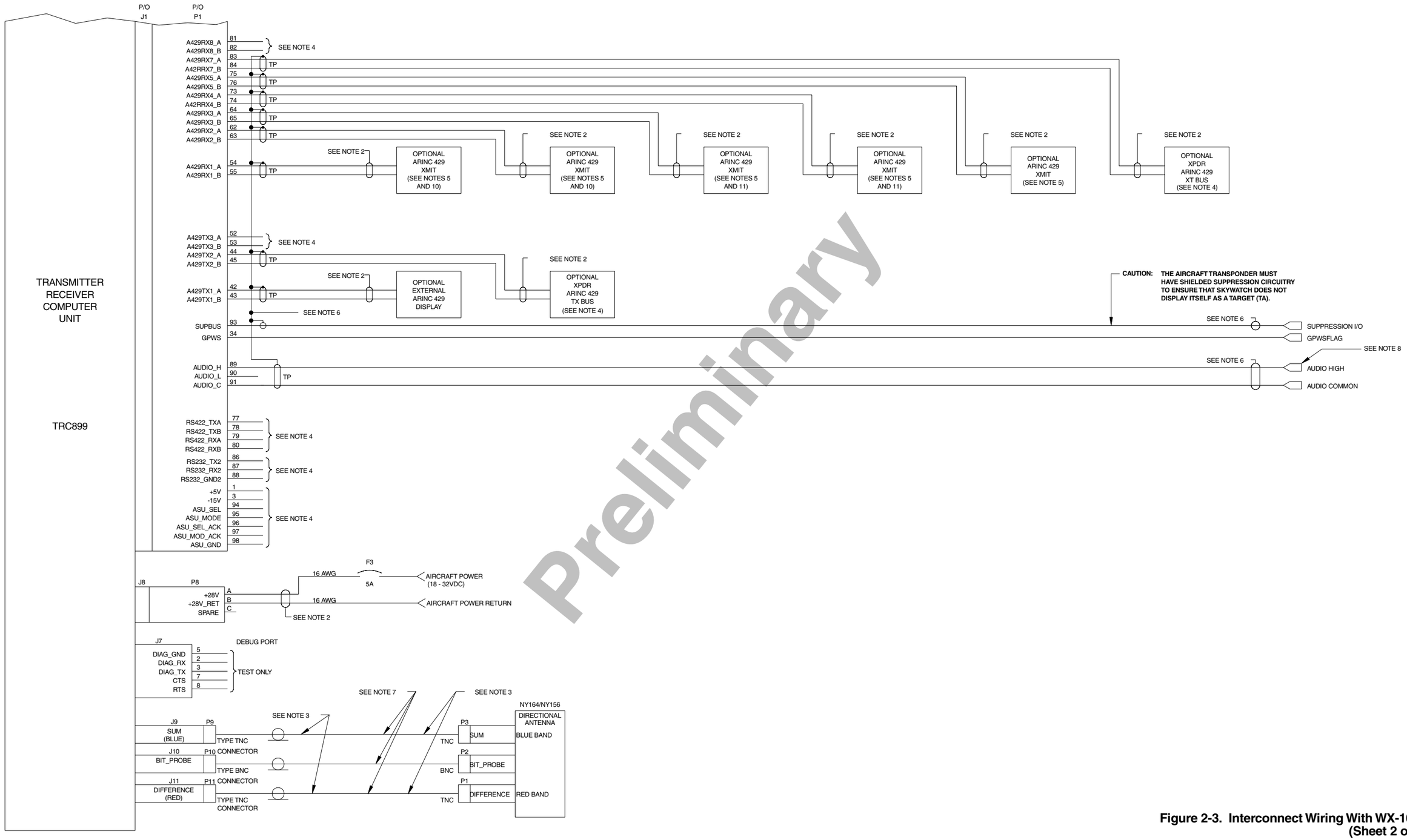
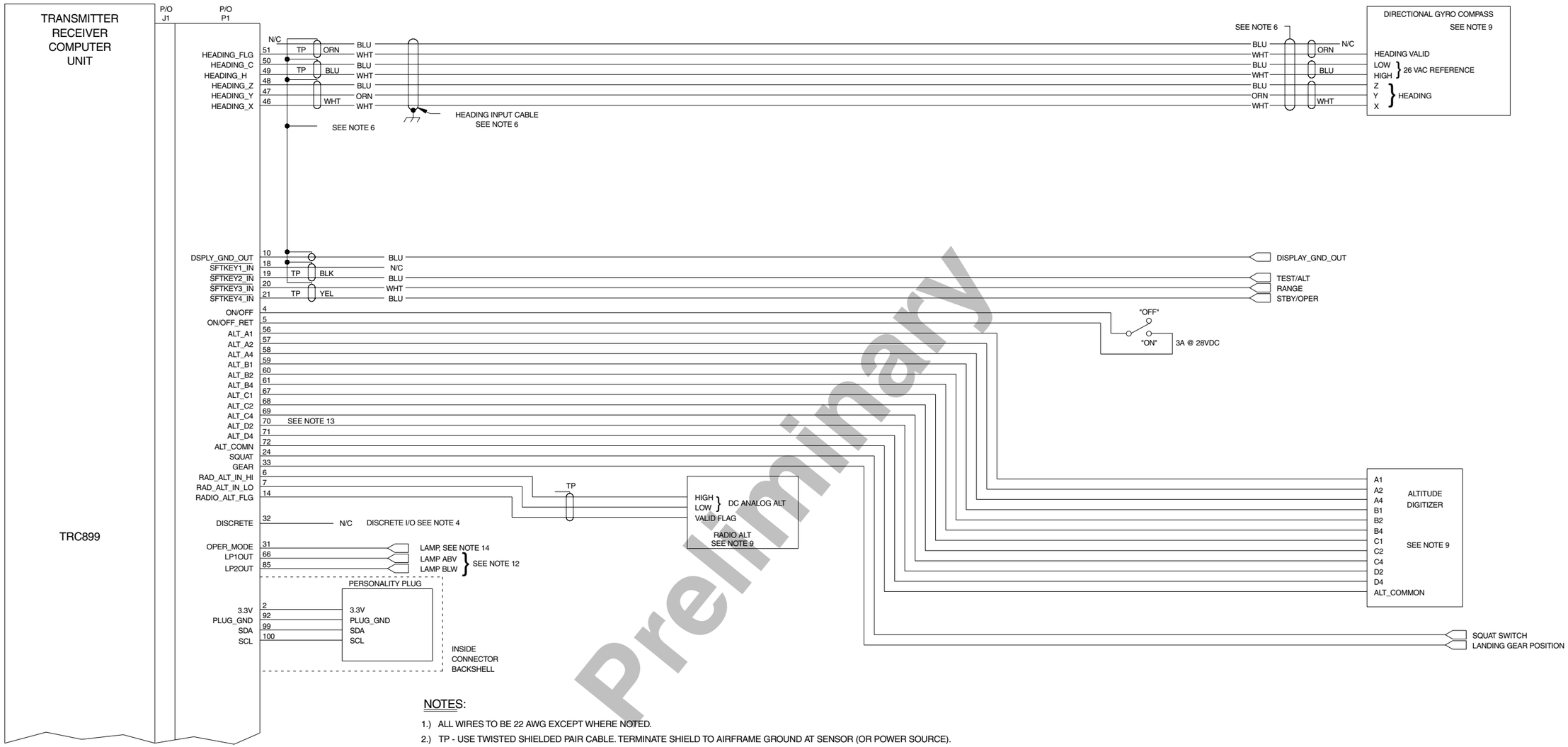


Figure 2-3. Interconnect Wiring With WX-1000 (Sheet 2 of 2)



NOTES:

1.) ALL WIRES TO BE 22 AWG EXCEPT WHERE NOTED.

2.) TP - USE TWISTED SHIELDED PAIR CABLE. TERMINATE SHIELD TO AIRFRAME GROUND AT SENSOR (OR POWER SOURCE).

3.) THE SUM CABLE WILL HAVE A BLUE BAND AT EACH END. THE DIFFERENCE CABLE WILL HAVE A RED BAND AT EACH END.

4.) FUTURE OPTION.

5.) A RADIO ALTIMETER, AIRDATA COMPUTER, OR OTHER ARINC 429 OUTPUT DEVICE MAY REPLACE ANALOG SENSORS FOR MAGNETIC HEADING, RADIO ALTITUDE, OR BAROMETRIC ALTITUDE.

6.) TIE THE OUTER SHIELD TO THE CONNECTOR BACKSHELL. CONNECTOR BACKSHELL IS CHASSIS GROUND.

7.) REFER TO INSTALLATION INSTRUCTIONS FOR CABLE SELECTION ON ANTENNA CABLES.

8.) USE AUDIO_H FOR 600 OHM AUDIO SYSTEMS. USE AUDIO_L FOR 150 OHM AUDIO SYSTEMS.

9.) DO NOT INSTALL EXTERNAL ISOLATION DIODES.

10.) THESE TWO DEVICES MUST BOTH BE HIGH SPEED OR BOTH BE LOW SPEED.

11.) THESE TWO DEVICES MUST BOTH BE HIGH SPEED OR BOTH BE LOW SPEED.

12.) ONLY USED WITH EXTERNAL DISPLAYS THAT DO NOT ANNUNCIATE ABOVE AND BELOW.

13.) IF D2 IS NOT USED THEN IT IS A "NO CONNECT" (N/C).

14.) OPTIONAL, MAY BE USED TO DRIVE INDICATOR DEPICTING OPERATIONAL MODE.

Figure 2-4. Interconnect Wiring with Alternate Display (Sheet 1 of 2)

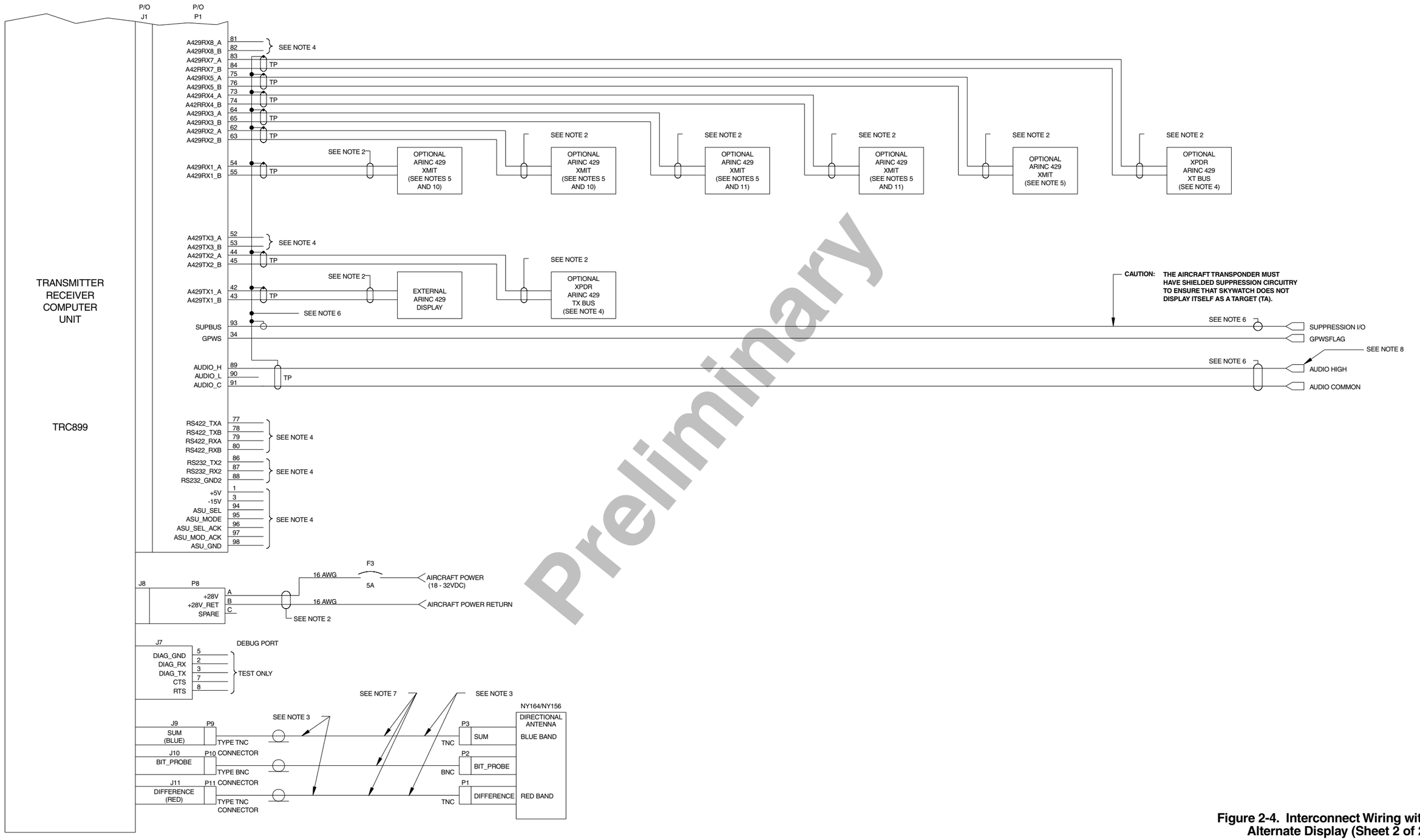


Figure 2-4. Interconnect Wiring with Alternate Display (Sheet 2 of 2)

2.5 DISPLAY LOCATION

The display should be mounted in a location easily accessible and clearly visible to the pilot. If using an alternate display device refer to manufacturer instructions for location. In selecting a location for WX-1000/SKY497 display, consider the following:

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 Avionics Systems. Specify P/N 78-8060-5882-8 when ordering.
Panel Depth	Adequate depth must be available behind the instrument panel to allow for the display, the display connector, and excess display cable. Remember that a service loop is necessary to allow access to the display connector when removing the display or inserting it into the instrument panel.
Cooling	While the display has no special cooling requirements, it should be mounted to permit adequate ventilation.
Viewing Angle	The viewing angle for the CRT display is not a critical factor. The most favorable mounting position would be near eye level and no more than arms length from the principle user of the instrument.

2.6 CABLE REQUIREMENTS AND FABRICATION

The installer will supply and fabricate all system cables. Cable specifications and approved vendors are provided in paragraph 1.7, equipment required but not supplied. Appendix A defines the electrical characteristics of all input and output signals and identifies the cable requirements for each signal. Required connectors and contact pins are supplied in the installation kits.

NOTES

1. Use of any cable not meeting BFG Avionics Systems specifications voids all system warranties.
2. All wiring must be in accordance with industry accepted methods, techniques and practices.
3. All wires are 22 AWG. except where noted, refer to figures 2-2, 2-3 and 2-4 for interconnect wiring information.

The length and routing of the external cables must be carefully studied and planned before attempting installation of the equipment. Observe the following precautions:

- ARINC-429 inputs (receive channels) must be paired with other ARINC-429 inputs of the same speed (12.5 or 100 kHz). Details are outlined in paragraph 2.9.
- All cable routing should be kept as short and direct as possible.
- Avoid routing the cables too close to aircraft control cables.
- Avoid routing cable near the ADF, comm radio, or transponder antenna cables (allow at least a 12 inch (30.5 cm) separation).
- Avoid routing cable near power sources (e.g., 400 Hz generators, trim motors, etc.) and near power for fluorescent lighting.
- Use pressurized bulkhead connectors certified for your specific aircraft pressurization.
- To limit the possibility of wire chafing, it is recommended that heat shrink sleeving be installed over the wire bundle between the shield termination's (inside the connector backshell) and the connector cable clamp.
- Observe all wiring notes on interconnect wiring diagram (figures 2-2, 2-3 and 2-4).

After fabricating the cables and before installing the equipment, use the interconnect diagram to verify continuity between each pin and its opposite end termination. Check resistance to ground between each connector pin. When a path to ground is detected, verify its validity. Figure A-1 P1 connector pin identifiers has been added to assist in fabrication and continuity verification of the interconnect cable.

2.6.1 Antenna Cables

NOTES

1. Use of any cable not meeting BFGoodrich Avionics Systems specifications voids all system warranties.
2. If you fabricate your own cables, you must verify that the attenuation and VSWR does not exceed the specified values.
3. To add strain relief and alleviate stress caused by aircraft vibration, place 4-6 inches (10.2 to 15.2 cm) of heat shrink tubing over each antenna connector and cable.

The directional antenna requires three cable assemblies; sum (Sigma Port), bit probe (Probe Port) and difference (Delta Port). Cable attenuation for the sum and difference ports must not exceed 2.5 dB. Attenuation for the bit probe cable must not exceed 6 dB. VSWR, on cables attached to the sum, bit probe, and difference ports, must not exceed 1.5:1. (See paragraph 1.7 for antenna cable vendors and specifications.)

At the antenna, each connector has an identifying color band. To ensure the cables are connected to the correct port, affix the following marking at the termination points of each cable:

Sum (Sigma) Port	The Sum (Sigma) port is the forward antenna connector. It is marked with a blue band. Fabricate the sum antenna cable with a TNC connector at each end. Affix a blue marking band on each connector. At the TRC, the sum port (J9) is identified with blue marking.
Bit Probe Port	The Bit Probe port is the center antenna connector. Fabricate the probe cable with a BNC connector at each end.
Difference (Delta) Port	The Difference (Delta) port is the rear antenna connector. It is marked with a red band. Fabricate the difference antenna cable with a TNC connector at each end. Affix red marking band on each connector. At the TRC, the difference port (J11) is identified with red marking.

When routing antenna cables, observe the following precautions:

- All cable routing should be kept as short (do not exceed maximum cable length detailed in table 1-6) and direct as possible.
- Avoid sharp bends (do not exceed maximum bend radius detailed in table 1-6).
- Avoid routing cable near power sources (e.g., 400 Hz generators, trim motors, etc.) and near power for fluorescent lighting.
- Avoid routing cable near ADF antenna cable (allow at least a 12-inch (30.5) separation).

2.6.2 Audio Output Cable

For audio output cable use #22 AWG (minimum) twisted shielded pairs with the shield grounded at both ends. Cable runs can be up to 30 ft., but should be as short as practicable.

2.6.3 Data Cables

RS-232, RS-422, and ARINC-429 data cables are #22 AWG (minimum) twisted, shielded cables. The shield shall be grounded at both ends and at all breaks. Cable runs should be as short as practicable.

2.6.4 Heading Input Cable

The heading input cable connects the TRC899 to the aircraft synchro heading system (refer to the Interconnect Wiring Diagram, figure 2-2, 2-3 or 2-4). Cable specifications are listed below (see paragraph 1.7 for cable vendors).

NOTE

Use of any cable not meeting BFG Avionics Systems specifications voids all system warranties.

The synchro cable consists of the following (refer to figure 2-5):

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 2, 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.

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.

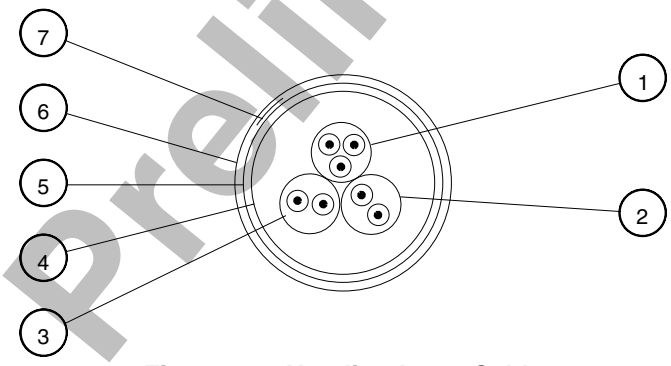


Figure 2-5. Heading Input Cable

2.6.5 Power Cable

For the power cable, use #16 AWG (minimum) twisted shielded pair cable (Beldon 83322, Alpha 2826/2, or equivalent). The power cable runs from the aircraft circuit breaker panel to the TRC. The power cable is connected to the TRC using the MS3126F12-3S connector included in the TRC installation kit. Terminate the shield to airframe ground at the power source. Power cable routing and length are not critical to system operation. The SKY899 is a 28 V dc system (18 to 32 V dc).

NOTE

5 A circuit breaker is required.

2.6.6 Suppression Bus Cable

For the suppression bus use any size low capacitance shielded cable. Cable runs should be as short as practicable and the shields should be grounded at both ends.

2.6.7 WX-1000/SKY497 Display and WX-1000 Processor Cable

The display cable connects the TRC to the WX-1000/SKY497 Display. Cable specifications are listed below (see paragraph 1.7 for cable vendors). If a WX-1000 *Stormscope*® Weather Mapping System is installed, the same cable is used to connect the TRC to a WX-1000 processor. Refer to figure 2-2 (without WX-1000 processor) or 2-3 (with WX-1000 processor) for interconnect wiring information. Pin-out information relating to the WX-1000 display and processor is also provided in tables 2-2 and 2-3.

For alternate display device cable see ARINC-429 data cable (par. 2.6.3) and refer to figure 2-4 for connections.

The display cable consists of the following (refer to figure 2-6).

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.

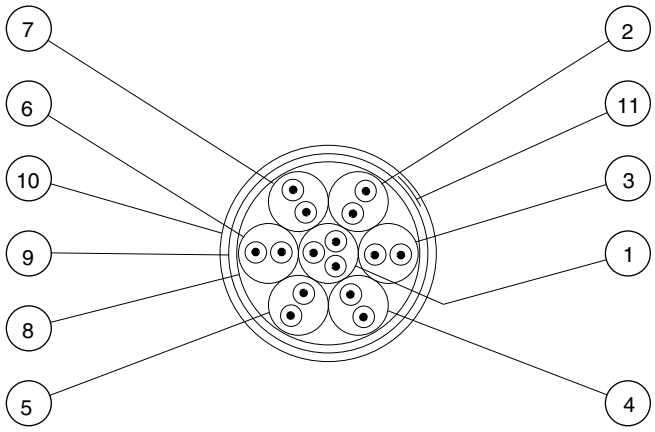


Figure 2-6. Display Cable

The sub-cable color-coded jackets and shields should be left on the sub-cables as close to the connectors as practical to provide the required shielding and to identify the sub-cables.

2.6.8 Converting Existing Aircraft Wiring from SKY497 to SKY899

In some instances, it may be desirable to convert an existing SKY497 installation to a SKY899 installation. The SKY899 is a new system with the addition of a system configuration module and a new TRC899. Even though the TRC899 resembles a TRC497, uses the same antenna and mounting hardware, the external connector P1 has different pinouts and is keyed differently to prevent the possibility of damaging a TRC. In order to relocate pin positions use the insertion and extraction tools listed in paragraph 1.7, under sub title "Connector Installation."

NOTE

All P1 connections will need to be moved from an existing pin location to a new pin location, as well as the addition of the system configuration module. Only the power and antenna connections remain the same.

Some of the differences:

TRC899	**TRC497**
• 7 ARINC-429 RX channels	2 ARINC-429 RX channels
• 3 ARINC-429 TX channels	1 ARINC-429 TX channel
• System Configuration Module (configure system in service menu)	Individual configuration pins
• Heading valid, 1 input pin (low/high level selected in service menu)	Heading valid, 2 input pins (low or high level)
• Analog radio altimeter	Not available
• 18 - 32 V dc power input	11 - 34 V dc power input
• ADS-B (requires mode S transponder address)	Not available
• Altimeter Gilham Code "D2" added (do not connect if not available)	Altimeter Gilham Code "D2" not available
• Lamp Outputs - above, below and oper_mode (used with alternate display)	Not available
• Transponder input/output	Not available
• Stepper (heading) not available	Stepper (heading) available

2.7 AIRCRAFT DISCRETE INPUTS

The aircraft discrete inputs are used to assist in determining the aircraft's phase of flight or flight condition (e.g., on ground or in flight). Inputs are diode isolated inside the TRC, do not install isolation diodes externally. The active or inactive state of the inputs can be high or low, they will be saved in the System Configuration Module during system setup using the service menu.

2.7.1 Audio Inhibit (Terrain Warning System - GPWS)

The audio inhibit input will sense a terrain warning alarm (i.e., GPWS, EGPWS, TAWS) and temporarily disable the audio alert output until the terrain warning clears. The input can be either a constant flag signal or an alternating flag output. The flag must be cleared for 5 seconds before the TRC accepts a "NO ALARM" condition and restores audible alerts.

NOTES

1. If the aircraft is equipped with terrain warning system, it must be connected to the TRC.
2. If the aircraft is not equipped with terrain warning system, leave this input unconnected.

Audio inhibit connection:

GPWS	P1-34

2.7.2 Landing Gear

This input is to be connected to the landing gear switch to sense the position of the landing gear (fixed, up or down). The switch status of this input is selected during system setup via the service menu. This input has three service menu options, none (fixed gear), active low (electrically ground with aircraft on the ground) and active high (electrically high (+9 V to +28 V) with aircraft on the ground).

Landing gear connection:

GEAR	P1-33

If the aircraft does not have a landing gear switch (e.g., fixed-gear aircraft), leave this input unconnected. With this configuration, if a radio altimeter (analog or ARINC-429) is not installed, the system will default to the highest TA sensitivity level (level B) and audio TA announcements (i.e., "traffic, traffic") will not be inhibited during takeoff and landing.

2.7.3 SKYWATCH/*Stormscope* Mode Switch

The SKYWATCH/*Stormscope* mode switch (SW1) is required only if a WX-1000 *Stormscope* Weather Mapping System is installed. This switch permits the flight crew to switch the display between the SKY899 and WX-1000. If a TA (Traffic Advisory) is detected while in the *Stormscope* mode, the display will switch to the SKYWATCH mode. Refer to figure 2-3 for interconnect wiring information. Any general purpose SPST toggle switch (3 Amp @ 28 V dc) may be used. Display mode switch cable routing and length are not critical to system operation. Mount the switch at a location easily accessible to the pilot.

SKYWATCH/*Stormscope* mode switch connections:

SMS	P1-15
SMS_RET	P1-23

2.7.4 Squat Switch (Weight-On-Wheels)

This input is to be connected to the squat switch (weight-on-wheels) to sense when the aircraft is on the ground. The switch status of this input is selected during system setup via the service menu. This input has three service menu options, none (no squat switch installed), active low (electrically ground with aircraft on the ground) and active high (electrically high (+9 V to +28 V) with aircraft on the ground).

NOTE

If the aircraft is not equipped with a squat switch, it is recommended that a squat switch be installed.

Squat switch connection:

SQUAT	P1-24

If a squat switch is not available, this input could be tied to an airspeed switch inline with the pitot system as an alternate input for the squat switch. In this configuration care should be taken to ensure the switch is set to trigger at a speed consistent with take-off and landing.

On helicopter installations with skids, and a squat switch is not available, this input can be tied to the collective switch. In this configuration care should be taken to ensure the switch is connected to provide a ground when the aircraft is on the ground and open when the aircraft is airborne.

If it is not possible to install a squat switch, airspeed switch, or collective switch, select none in service menu. With this configuration the pilot must toggle the system in and out of standby manually. Traffic will only be displayed when the pilot switches out of the standby position.

With a squat switch installed, SKYWATCH HP will automatically switch out of standby 8 to 10 seconds after takeoff and switch back to standby 24 seconds after landing. A squat switch would also prevent the pilot from placing SKYWATCH HP in standby (i.e., pressing the →STB button) while the aircraft is in-flight.

2.7.5 *ON/OFF* Power Switch

This input connection turns the TRC ON and OFF. Wiring of this input will vary depending upon your specific installation. With pin P1-4 connected to P1-5 the system will turn on. There are three possible configurations discussed below:

Alternate Display. A separate ON/OFF switch is required (any SPDT toggle switch rated at 3A @ 28 V dc can be used). Refer to display manufactures instructions and figure 2-4 concerning this connection.

WX-1000/SKY497 Display (without WX-1000). Connect per figure 2-2.

***Stormscope* WX-1000 Installation**. This external over-ride switch (SW2) is required if a WX-1000 *Stormscope* Weather Mapping System is installed. The override switch enables the SKYWATCH HP to be powered-up if the WX-1000 processor has been removed for maintenance. During normal operation the switch should remain in the NORMAL position and moved to OVERRIDE only if the WX-1000 processor has been removed for service or if it is necessary to access the WX-1000 service menu. Connect per figure 2-3

Any general purpose DPDT toggle switch (3 Amp @ 28 V dc) may be used. The maintenance switch cable routing and length are not critical to system operation. The switch can be located in the avionics bay near the WX-1000 processor.

ON/OFF power switch connection:

ON/OFF	P1-4
ON/OFF_RET	P1-5

2.8 ALTERNATE DISPLAY

Alternate display (ARINC-735 compatible is required for TCAS I installation) is connected to ARINC-429 output channel. Refer to paragraph 2.9 for ARINC-429 output channel information.

2.9 ARINC-429

The ARINC-429 interface can be divided into four sections: general sensor inputs, mode S transponder input/output, alternate display output and future input/output options. The TRC has seven receive channels and three transmit channels that are used to accomplish the various interfaces. However, two receiver and two transmitter channels are not used at this time (future option). ARINC-429 labels accepted and transmitted are listed in tables A-3 and A-4.

2.9.1 General Sensor Inputs

The TRC can use four general sensor inputs: barometric altimeter, radio altimeter, magnetic heading, and GPS navigation data. Five receive channels have been designated for these inputs and will allow various combinations of speed and equipment types. It is also possible for multiple data inputs (barometric altimeter, radio altimeter, magnetic heading and GPS navigation) from one source to be received on one channel (e.g., ARINC-429 superbus). Receiver speed and equipment type must be set via the service menu. When planning the ARINC-429 interface note the following:

NOTES

1. The data rate for RX channels 1 and 2 must be set to the same speed (12.5 or 100 kHz).
2. The data rate for RX channels 3 and 4 must be set to the same speed (12.5 or 100 kHz).
3. The data rate for channel 5 is independent of the other receivers. Channel 5 can be set to 12.5 or 100 kHz.

ARINC-429 General Sensor Input connections:

A429RX1_A (P1-54)
A429RX1_B (P1-55)
A429RX2_A (P1-62)
A429RX2_B (P1-63)

A429RX3_A (P1-64)
A429RX3_B (P1-65)
A429RX4_A (P1-73)
A429RX4_B (P1-74)

A429RX5_A (P1-75)
A429RX5_B (P1-76)

2.9.2 Mode S Transponder I/O (future option)

The TRC has one receive and one transmit channel designated for the mode S transponder XT & TX bus interface. The receiver and transmit speed is fixed at 100 kHz. This is a future option, do not connect at this time.

Mode S Transponder XT bus connections:

A429RX7_A (P1-83)
A429RX7_B (P1-84)

Mode S Transponder TX bus connections:

A429TX2_A (P1-44)
A429TX2_B (P1-45)

2.9.3 Alternate Display Output

The TRC has one transmit channel designated for alternate displays (i.e., EFIS, MFD and weather radar via RGC250). The transmitter speed is fixed at 100 kHz. The display driver must be selected via the service menu. The display drivers control the ranges and information that will be presented on the alternate display. The drivers are listed in table 2-1 along with their specifications.

NOTE

When an alternate display is selected via the service menu the alternate display is the master display and the WX-1000/SKY497 display is the slave (i.e., display range settings are controlled by the alternate display driver).

Alternate Display connections:

A429TX1_A (P1-42)
A429TX1_B (P1-43)

Table 2-1. Alternate Display Drivers

DISPLAY DRIVER NAME	DISPLAY RANGES	STANDBY RANGE	SELF-TEST RANGE	REMARKS
None	-	-	-	No alternate display connected must use WX-1000/SKY497 display.
Standard Type 1	2, 6, 15 nmi	15 nmi	6 nmi	
Standard Type 2	6, 12, 20 nmi	12 nmi	6 nmi	
Standard Type 3	5, 10, 20 nmi	10 nmi	5 nmi	
Sextant Type 1	6, 12, 24 nmi	12 nmi	6 nmi	Displays unrestricted mode, must use external lamps to annunciate UNR mode.
Sextant Type 2	6, 12, 24 nmi	12 nmi	6 nmi	Does not display unrestricted mode
Sextant CG	6, 12, 24 nmi	6 nmi	6 nmi	Does not display unrestricted mode
Forestry Serv	2, 5, 10, 20 nmi	10 nmi	5 nmi	
Collins EFIS Type 1	5, 10, 25 nmi	10 nmi	5 nmi	Sends only 8 most threatening intruders to display. EFIS changes ranges internally.

2.9.4 Future Option

The TRC has one spare receiver A429RX8_A (P1-81) & A429RX8_B (P1-82) and one spare transmitter A429TX3_A (P1-52) & A429TX3_B (P1-53) reserved for a future option. Do not connect these I/O channels.

2.10 AUDIO (ALERT) OUTPUT

Voice messages are output to the aircraft audio system, unless the audio inhibit input (from GPWS) is active. The audio output is disabled when a terrain warning system (GPWS) alarm is detected and remains disabled until the warning clears.

Two outputs, 150 ohm and 600 ohm, can supply up to 40 mW to the audio distribution system. Volume level is set via the Service Menu.

Audio output connections:

AUDIO_H	P1-89 (600 Ohm)
AUDIO_L	P1-90 (150 Ohm)
AUDIO_C	P1-91 (Audio Common)

2.11 BAROMETRIC (UNCORRECTED) ALTITUDE INPUTS

The TRC requires an uncorrected barometric altimeter input. The barometric altitude can be gilham code or ARINC-429 (air data computer (ADC)).

NOTES

1. Only one uncorrected barometric altimeter input source, either gilham code, ARINC-429 (ADC) should be connected.
2. The uncorrected barometric altimeter input (gilham code or ARINC-429) should be from the same source that is interfaced with the transponder or it must be at least as accurate as that source, i.e., ± 125 ft.

2.11.1 Gilham Code (Encoding Altimeter)

These signals are gilham code inputs coming from an airdata computer or altitude digitizer (encoding altimeter). These 11 lines may be connected in parallel with the aircraft transponder. If the aircraft is equipped with selectable altitude encoders, connect the altitude inputs so that SKY899 is always connected to the selected encoder. (Reference ARINC 572-1.)

NOTE

If the aircraft has switched encoders that use 28V RETURN or AIRCRAFT GROUND as reference for encoder selection, then ALTITUDE COMMON should be left unconnected.

Altitude encoder connections:

A1 -to- P1-56	B1 -to- P1-59	C1 -to- P1-67	D2* -to- P1-70
A2 -to- P1-57	B2 -to- P1-60	C2 -to- P1-68	D4 -to- P1-71
A4 -to- P1-58	B4 -to- P1-61	C4 -to- P1-69	

ALTITUDE COMMON - to P1-72

* If D2 is not used P1-70 should remain unconnected

2.11.2 ADC (ARINC-429)

ADC (ARINC-429) speed can be 12.5 or 100 kHz and must be paired with another input device set to the same speed. Refer to paragraph 2.9 for ARINC-429 receiver channel information.

2.12 GPS (ARINC-429)

The GPS (ARINC-429) speed can be 12.5 or 100 kHz and must be paired with another input device set to the same speed. Refer to paragraph 2.9 for ARINC-429 receiver channel information. In order to use ADS-B, SKYWATCH HP requires a GPS input that is GAMA or ARINC-743A compliant.

2.13 HEADING INPUT

The magnetic heading can be provided by synchro (XYZ) or ARINC-429 (attitude heading and reference system), depending on the configuration settings. Heading source will be selected during system setup via the service menu. Select only one heading source for the input.

2.13.1 Compass Synchro (XYZ)

Synchro (XYZ) heading input accepts ARINC 407, 407-1 signals. The FLAG line input provides the TRC with flag status (or heading valid) information. The status of the heading valid signal can be none, active high, or active low (see appendix A for signal characteristics) and must be selected during system setup via the service menu.

Synchro (XYZ) heading connections:

HEADING_X	P1-46 (Synchro X)
HEADING_Y	P1-47 (Synchro Y)
HEADING_Z	P1-48 (Synchro Z)
HEADING_H	P1-49 (26 V ac High)
HEADING_C	P1-50 (26 V ac Low)
HEADING_FLG	P1-51 (Heading Valid)

2.13.2 AHRS (Attitude Heading and Reference System)

AHRS provides aircraft attitude and heading values via the ARINC-429 bus. ARINC-429 receiver channel speed can be 12.5 or 100 kHz and must be paired with another input device set to the same speed. Refer to paragraph 2.9 for ARINC-429 receiver channel information.

2.14 LAMP OUTPUTS (ABV and BLW)

The lamp outputs are used only with an alternate display that is not capable of annunciating the vertical display modes for above (ABV) and below (BLW). Outputs are switched to ground when active. The lamps require a separate dc source (constant or dimming circuit). If lamp voltage is an ac source then an isolation relay must be used.

Lamp connections:

LP1OUT	P1-66 (ABV)
LP2OUT	P1-85 (BLW)

Depending on the vertical display mode selected the appropriate annunciator(s) will light. If in normal mode neither lamp will light, if in above mode the ABV lamp will light, if in below mode the BLW lamp will light, and when unrestricted vertical mode is selected both lamps will light. See figure 2-7.

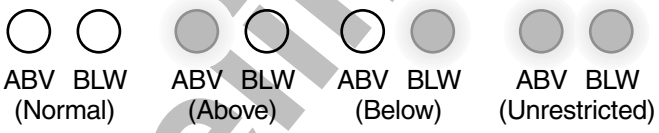


Figure 2-7. Above and Below External Lamps

2.15 OPERATIONAL MODE OUTPUT (optional)

Operational mode output can drive a lamp annunciating when the system is in operational mode (i.e., not in standby mode). Output is switched to ground when system is in operation mode. The maximum current draw is 300 mA. The lamp requires a separate dc source (constant or dimming circuit). If lamp voltage is an ac source then an isolation relay must be used.

Operational mode connection:

OPER_MODE P1-31

2.16 POWER INPUT

The SKY899 is a 28 V dc system (18 to 32 V dc) and requires a 5A circuit breaker. See paragraph 2.6.5 for cable and shield connection information.

Power connection:

+28V	P8-A
+28V_RET	P8-B
SPARE	P8-C

2.17 RADIO ALTIMETER (optional)

It is recommended an radio altimeter be connected to the TRC, which will be used in selecting the appropriate sensitivity level based on your distance above ground. The TRC can accept radio altimeter input from analog or ARINC-429 source.

NOTE

The radio altimeter must provide full range output between 0 and 2500 feet. Not all altimeters provide this full range output. The full range output can sometimes be obtained as a mod to the radio altimeter. Check with the specific altimeter manufacturer for compatibility and availability of modification, if necessary.

2.17.1 Analog

This interface allows a DC analog radio altimeter to be used to monitor own aircraft height above ground and includes input for radio altitude valid signal. Some analog radio altimeters utilize a discrete valid/invalid signal line to indicate radio altitude validity, while others set the analog data input line to a high out-of-range value for invalid altitude conditions. If a discrete flag signal is not available leave RAD_ALT_FLG (P1-14) unconnected and select None in the Service Menu (Rad Alt Flag sub-menu).

Analog radio altitude connections:

RAD_ALT_IN_HI	P1-6 (High)
RAD_ALT_IN_LO	P1-7 (Low)
RAD_ALT_FLG	P1-14 (Valid Flag)

2.17.2 ARINC-429

Radio altimeter ARINC-429 speed must be paired with another input device set to the same speed, either low (12.5 kHz) or high (100 kHz). Refer to paragraph 2.9 for ARINC-429 receiver channel information.

2.18 SERIAL DATA

The TRC has one RS-232 debug port (J7, terminal device) for service menu access. The TRC has an auxiliary RS-232 and RS-422 data bus designated for future use (do not connect at this time).

Debug port connection:

DIAG_GND	P7-5
DIAG_RX	P7-2
DIAG_TX	P7-3
CTS	P7-7
RTS	P7-8

Auxiliary RS-232 connection (future use):

RS232_TX2	P1-86
RS232_RX2	P1-87
RS232_GND2	P1-88

Auxiliary RS-422 connection (future use):

RS422_TXA	P1-77
RS422_TXB	P1-78
RS422_RXA	P1-79
RS422_RXB	P1-80

2.19 SOFT-KEYS

If using a WX-1000/SKY497 display connect the soft-keys 1 thru 4 per figures 2-2 or 2-3.

When using an alternate display device reference figure 2-4 as well as manufacturer instructions concerning these connections. Required soft-key connections will depend upon the alternate display capabilities.

2.20 SUPPRESSION BUS I/O

The TRC outputs a 100 µs (± 5 µs) suppression pulse on the aircraft suppression bus (P1-93). In addition, the TRC899 receives suppression signals from all other devices on the suppression bus (e.g., transponder, DME). (Reference ARINC 735-2 and DO-197.)

CAUTION

The aircraft transponder must have suppression circuitry to ensure that SKY899 does not paint itself as a target (e.g., TA).

2.21 SYSTEM CONFIGURATION MODULE

The system configuration module (figure 2-8) is used to store aircraft installation dependent information (e.g., aircraft type, discrete inputs, heading source, speed of data bus, etc.). Aircraft specific information is selected via the service menu, typically during system setup. Once the setup settings have been saved the system configuration will stay with the aircraft wiring allowing the TRC to be replaced or exchanged without having to re-configure the TRC. When powered up the configuration information is sent to the TRC via the bi-directional serial data bus (SDA).

NOTE

The system configuration module must be located inside the backshell of connector P1 and wire-tied to the bundle of wires. Reference figure 2-9.

System Configuration Module connections:

System Configuration Module			TRC899	
Red	(VCC)	-to-	P1-2	(+3.3V)
Black	(Ground)	-to-	P1-92	(PLUG_GND)
Green	(Serial Clock)	-to-	P1-100	(SCL)
Yellow	(Serial Data)	-to-	P1-99	(SDA)

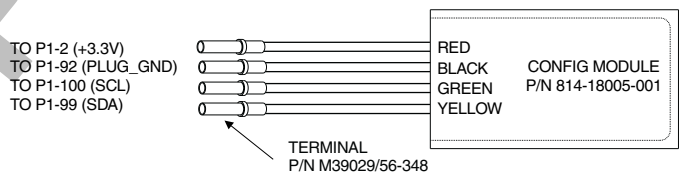


Figure 2-8. System Configuration Module

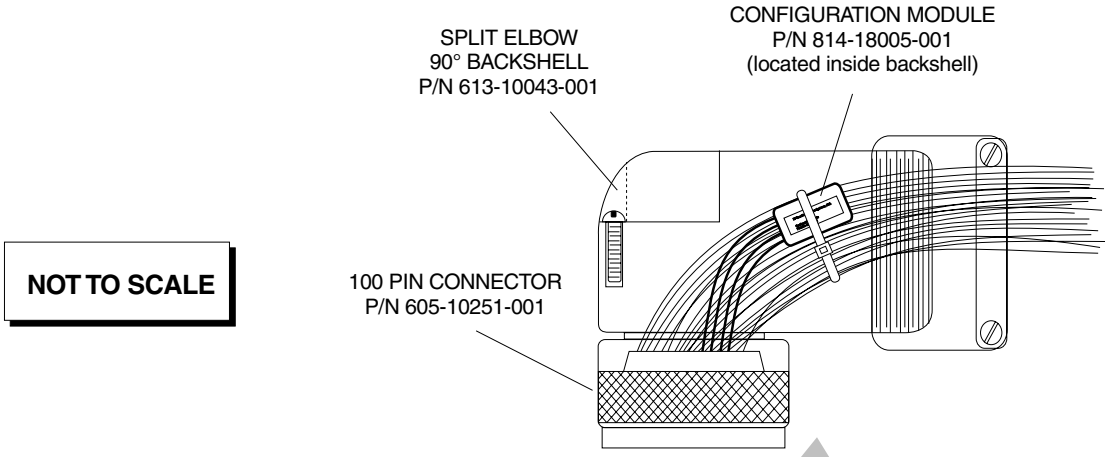


Figure 2-9. Typical Location of System Configuration Module (Inside Backshell)

2.22 WX-1000/SKY497 DISPLAY (OPTIONAL)

The WX-1000/SKY497 display can be used to display traffic alert/advisory information as well as *Stormscope* information. Connections are listed in table 2-2.

Table 2-2. WX-1000/SKY497 Display Connection

FUNCTION	Display P101	WIRE COLOR SUB-CABLE	WIRE	TRC P1
(Inner Jackets)	2			
DPWR+15_OUT	19	WHITE	WHITE	P1-8
DPWR-15_OUT	14	WHITE	ORANGE	P1-9
DSPLY_GND	18	WHITE	BLUE	P1-10
HSYNC_OUT_HI	6	BLUE	BLUE	P1-11
HSYNC_OUT_LO	5	BLUE	WHITE	P1-12
VSYNC_OUT_HI	9	ORANGE	WHITE	P1-13
VSYNC_OUT_LO	10	ORANGE	BLUE	P1-22
VIDEO_OUT_HI	8	RED	WHITE	P1-16
VIDEOOUT_LO	7	RED	BLUE	P1-17
PWR_SW_HI	22 (SW2*)	GREEN	WHITE	P1-4
PWR_SW-LO	23 (SW2*)	GREEN	BLUE	P1- 5
SFTKEY1_IN	13	BLACK	WHITE	P1-18
SFTKEY2_IN	12	BLACK	BLUE	P1-19
SFTKEY3_IN	25	YELLOW	WHITE	P1-20
SFTKEY4_IN	24	YELLOW	BLUE	P1-21

*SW2 required if WX-1000 Processor installed (see figure 2-2).

2.23 WX-1000 PROCESSOR (OPTIONAL)

The SKYWATCH HP can be interfaced to the *Stormscope* weather mapping system. The connections are listed in table 2-3.

Table 2-3. WX -1000 Processor Connection

FUNCTION	WX-1000 Processor	WIRE COLOR		TRC899
		SUB-CABLE	WIRE	
SHIELD	P301-5			
PWRSWHI	P301-21	GREEN	WHITE	SW2*
PWRSWLO	P301-20	GREEN	BLUE	SW2*
+15	P301-3	WHITE	WHITE	P1-25
-15	P301-36	WHITE	ORANGE	P1-26
DSPGND	P301-38	WHITE	BLUE	P1-27
HSYNCHI	P301-6	WHITE	BLUE	P1-28
HSYNCLO	P301-23	BLUE	WHITE	P1-29
VSYNCHI	P301-40	ORANGE	WHITE	P1-30
VSYNCLO	P301-7	ORANGE	BLUE	P1-41
VIDEOHI	P301-22	RED	BLUE	P1-35
VIDEOLO	P301-39	RED	WHITE	P1-36
SFTKEY1	P301-9	BLACK	WHITE	P1-37
SFTKEY2	P301-26	BLACK	BLUE	P1-38
SFTKEY3	P301-43	YELLOW	WHITE	P1-39
SFTKEY4	P301-44	YELLOW	BLUE	P1-40

*SW2 required if WX-1000 Processor installed (see figure 2-2).

2.24 ANTENNA INSTALLATION

The following paragraphs provide installation details for directional antenna. Standard installation practices prescribed in FAA Advisory Circular No. 43.13 must be followed. The installer must ensure the immediate antenna installation area is clean and prepared so that the antenna is electrically bonded (metal-to-metal contact) to the aircraft. To provide optimum bonding through the mounting holes, prepare the surfaces with Alodine No. 1001.

To facilitate mounting to the airframe, the dimensions shown in Figure 2-10 can be used to locate and drill mounting and connector access holes. Connection to the antenna should be made in accordance with the system interconnect diagram (figure 2-2, 2-3 or 2-4).

NOTE

A doubler plate (not supplied) is required to reinforce the aircraft skin.

1. Connect each of the three antenna cables. Check to ensure that each cable is connected to the correct antenna connector. Each connector/cable has a matching color band (see note par.2.6.1).
2. Attach the antenna to the aircraft, with the special adapter plate and o-ring, using 10-32 hardware provided. See Figure 2-11.

NOTES

1. When mounting the antenna remove the O-ring from the bag and install it in the O-ring groove on the bottom of the antenna.
2. For pressurized aircraft, use a sealant that meets the requirements of SAE AMS-S-8802 such as Flamemaster CS3204 class B. For non-pressurized aircraft, use a non-corrosive sealant that meets the *physical* requirements of MIL-A-46146 such as General Electric RTV162.

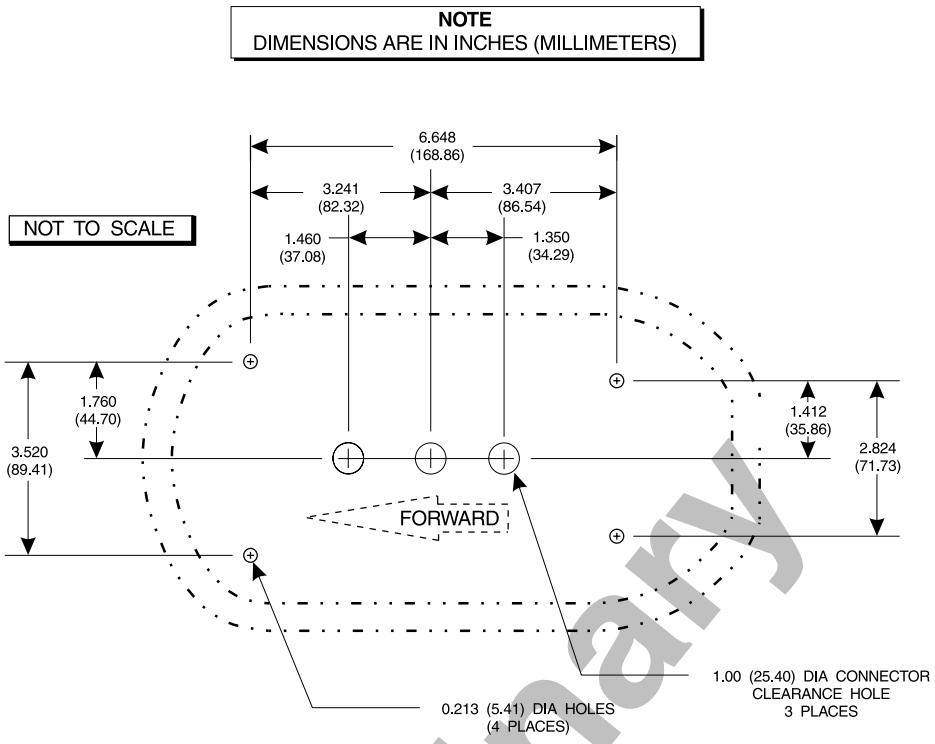


Figure 2-10. Antenna Mounting Holes

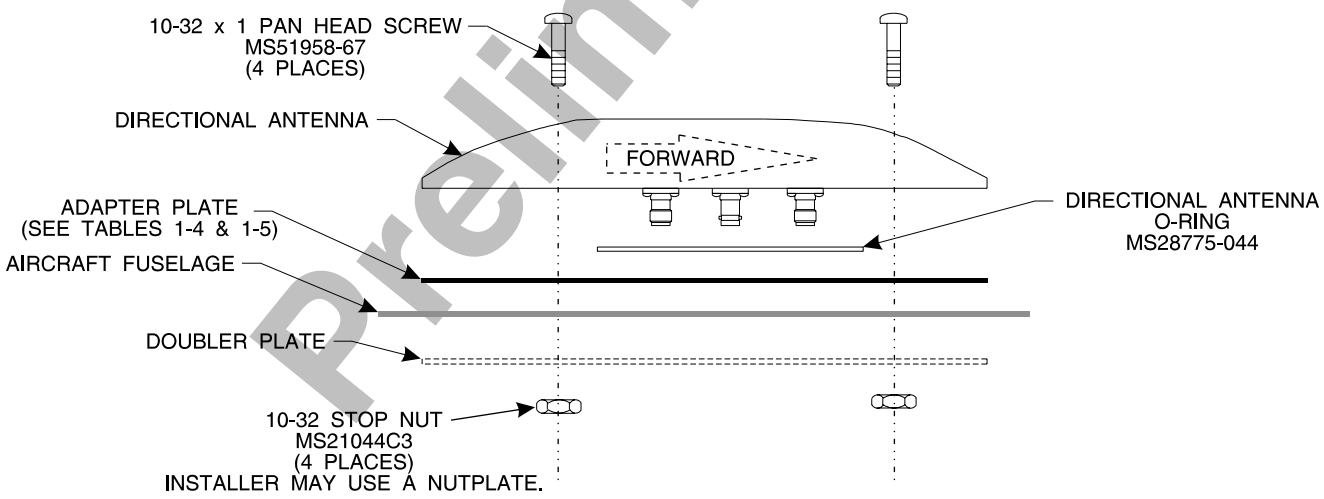


Figure 2-11. Directional Antenna Installation

2.25 TRC MOUNTING TRAY INSTALLATION

To accommodate different space limitations, the standard TRC mounting tray (P/N 805-10870-001) can be channel or flat mounted. To flat mount the tray, simply remove the eight 6-32 (Phillips) screws that secure the channel to the tray. The ruggedized TRC mounting tray (P/N 805-10870-003), required for rotorcraft installations, must be channel mounted.

1. Position tray at the installation location.

2. Determine centers for mounting holes, and drill for required fasteners. See figure 2-12 (standard tray) or 2-14 (ruggedized tray).
3. Secure tray in place using suitable 8-32 (channel mount) or 6-32 (flat mount) hardware.

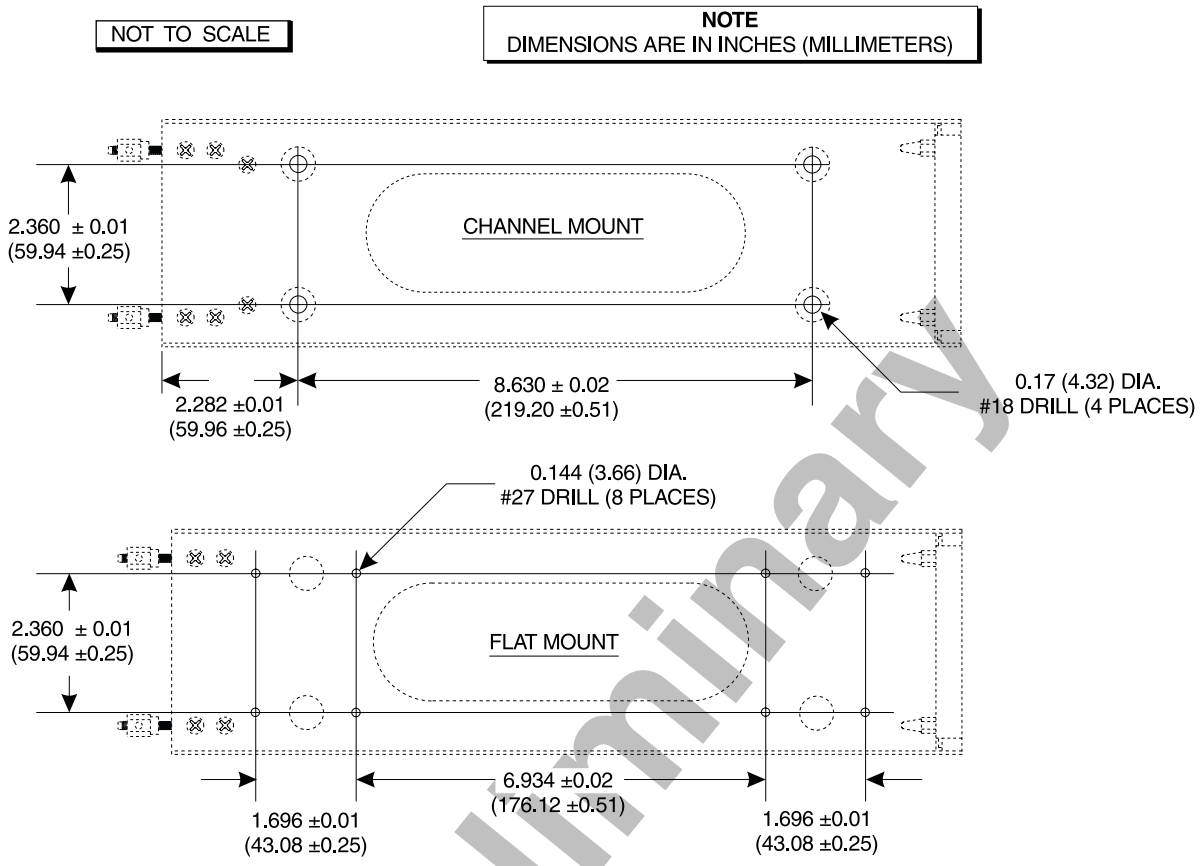


Figure 2-12. Mounting Holes for Standard Mounting Tray, P/N 805-10870-001

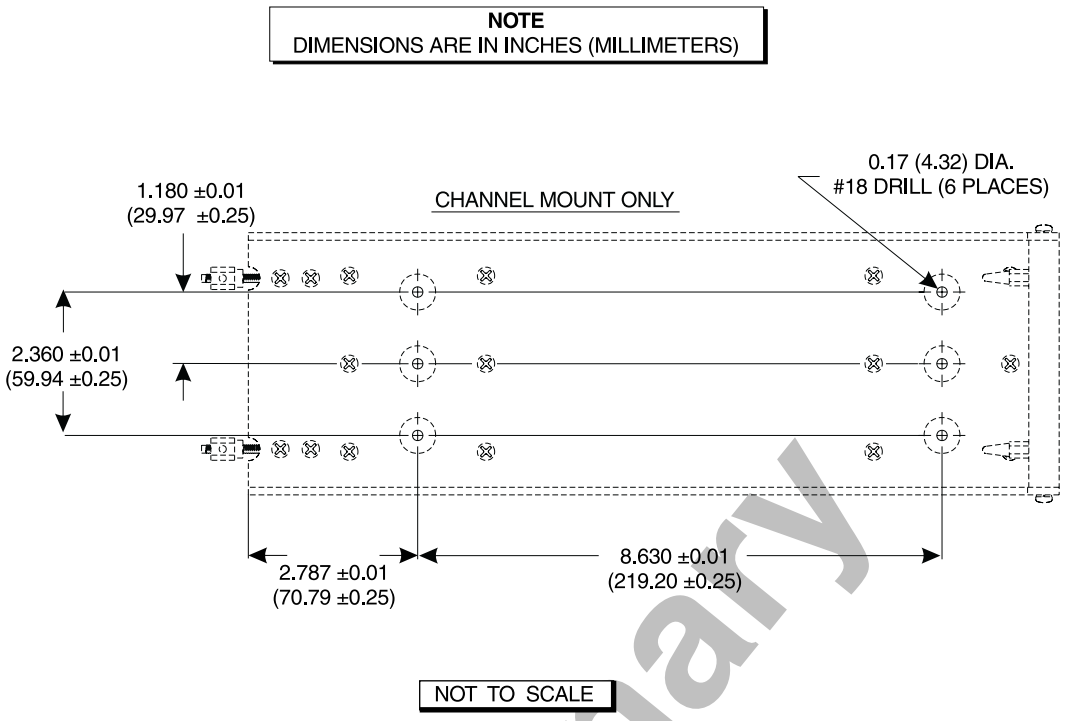


Figure 2-13. Mounting Holes for Ruggedized Mounting Tray, P/N 805-10870-003

2.26 TRC INSTALLATION

CAUTION

Before placing the TRC into its mounting tray, de-energize or disconnect all power and signal sources and loads used with the SKY899 system.

1. Slide the TRC into the mounting tray (see figure 2-14). Ensure that the rear hold-down pins on the mounting tray are properly inserted into receptacles on the TRC.
2. Place the retainer cups over the TRC J-hooks. Secure the TRC to the mounting tray by tightening the self-locking hold-down knobs.
3. Connect the three antenna inputs to the connectors on the front panel.
   a. Connect the Sum port antenna connector (P9 - a TNC connector identified with a blue band) to connector J9 (identified with blue marking).
   b. Connect the Probe (Bit) port antenna connector (P10 - a BNC connector identified with a black band) to connector J10.
   c. Connect the Difference (Delta) port antenna connector (P11 - a TNC connector identified with a red band) to connector J11 (identified with red marking).
4. Connect I/O Signal Cable (P1 - a 100-pin connector) to connector J1.
5. Connect the power cable (P8 - a three-pin connector) to connector J8.

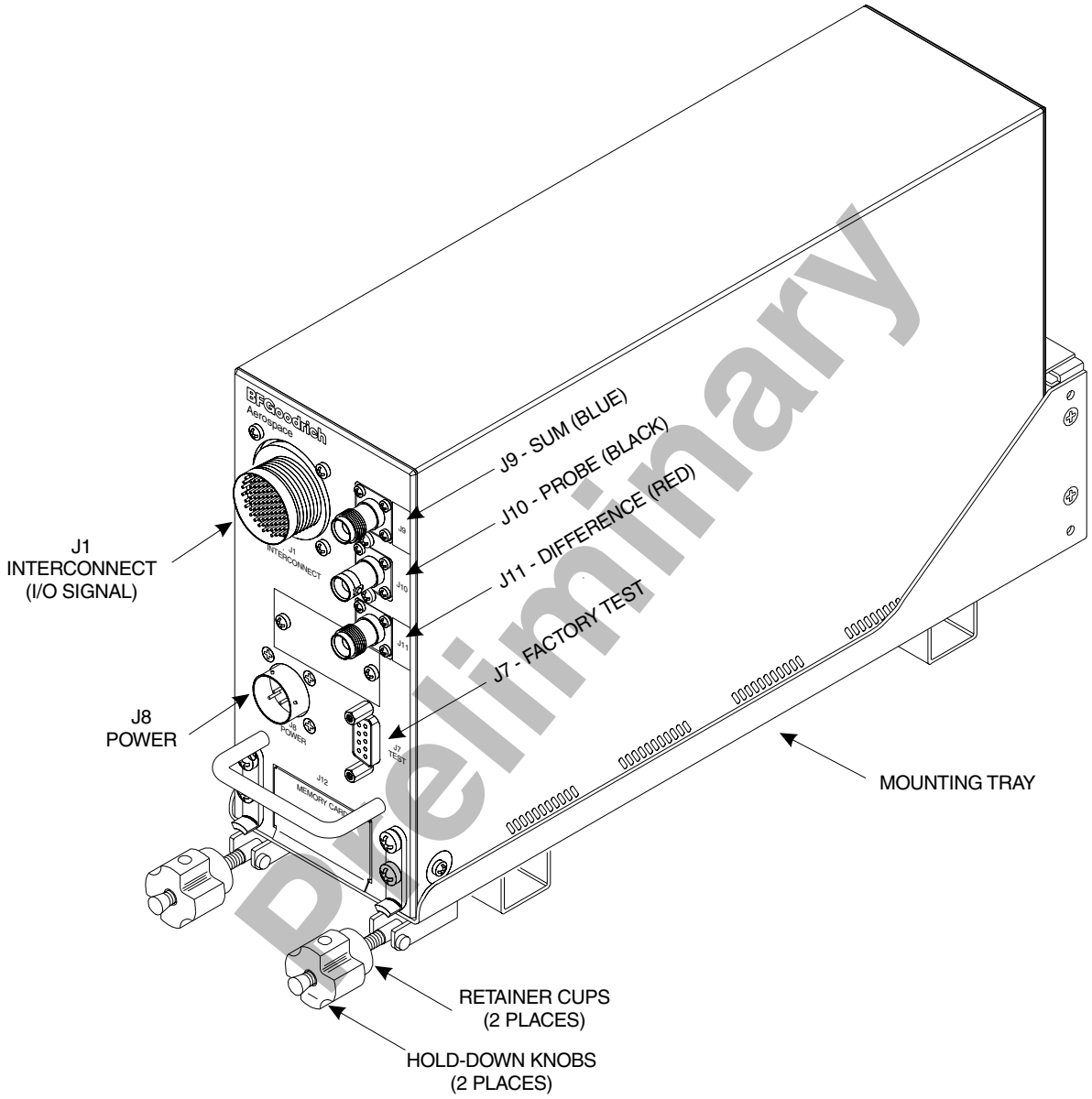


Figure 2-14. TRC899 Installation

2.27 MOUNTING THE WX-1000/SKY497 DISPLAY

The display mounts in a standard 3ATI panel cutout (figure 2-15). The unit may be mounted from the front or rear. The following paragraphs describe the installation procedure.

2.27.1 Panel Cutout

Refer to figure 2-15 for the panel cutout and mounting hole dimensions. Drill and punch the required holes. The instrument panel cutout is a standard 3ATI.

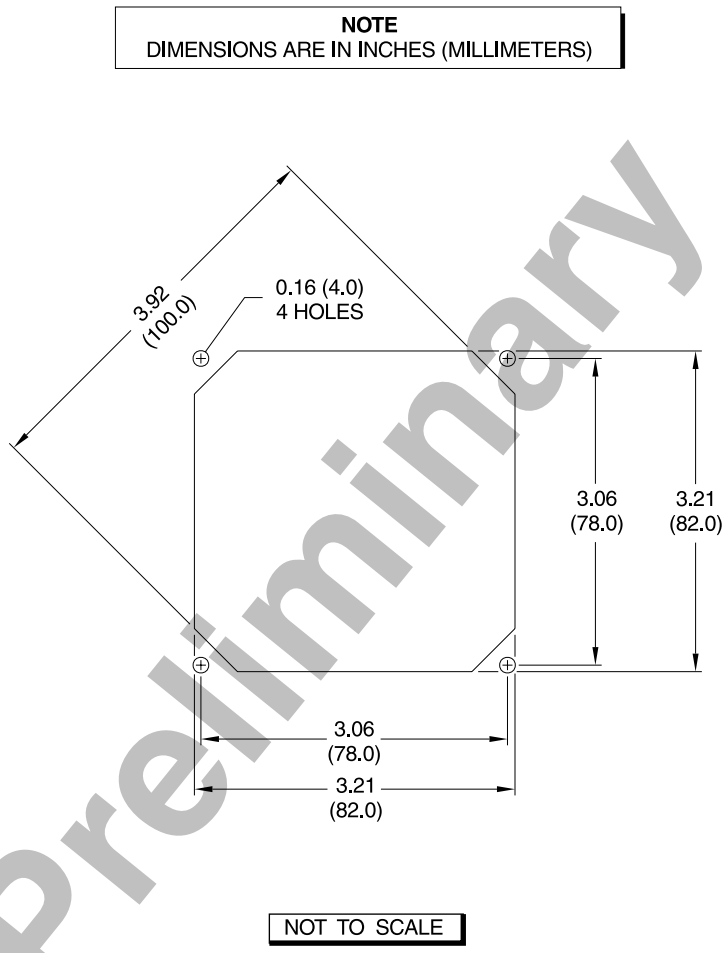


Figure 2-15. Instrument Panel Cutout and Mounting Holes

2.27.2 Display Installation

Figure 2-16 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.

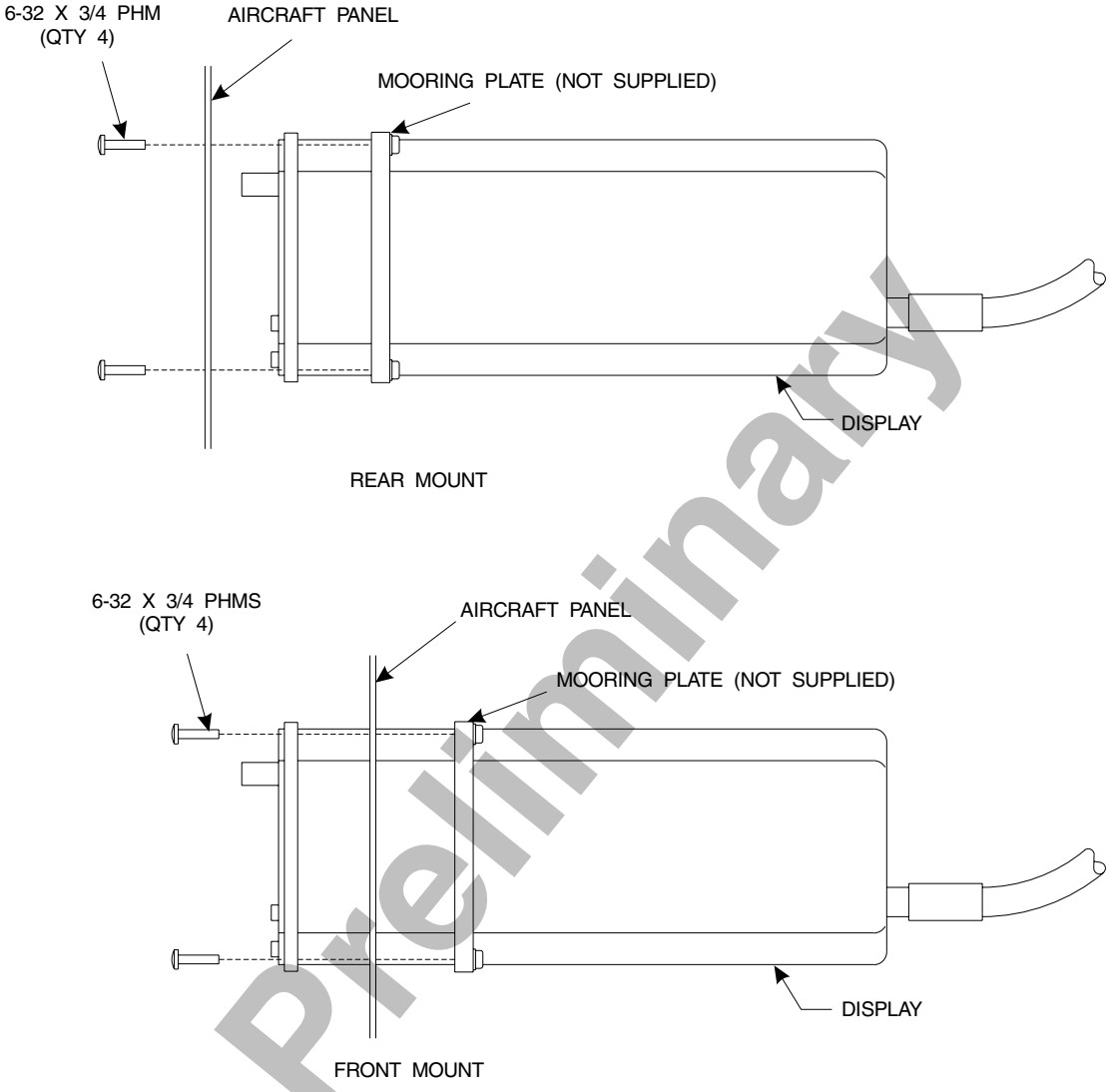


Figure 2-16. Display Installation

Use rivnuts® or a mooring clamp to secure the display to the instrument panel.

NOTE

1. The mooring clamp is not furnished with the display.
2. A mooring clamp (P/N 78-8060-5856-2) can be ordered when the order for the display is placed.
3. A 3ATI mooring clamp is also available from:

   MSP, Incorporated
   R.R. 4, Box 383A
   Nashville, Indiana 47448
   Tel. (812) 988-6623 or FAX (812) 988-6181

CHAPTER 3
INSTALLATION CHECKOUT

3.1 INTRODUCTION

This section contains instructions for using the BFGoodrich Avionics Systems TT391 Flightline Tester to do post-installation checkout of the SKY899. Detailed setup, operation and maintenance information for the TT391 Flightline Tester is provided in the TT391 Instruction Manual.

NOTES

1. This procedure assumes familiarity with the set up and operation of the TT391 Flightline Tester.
2. All test equipment used in completing these tests shall be calibrated in accordance with the manufacturer's recommendations.
3. This section provides checkout information for the SKY899 using the WX-1000 Display. If using an alternate display use Appendix F for installation checkout.
4. Checkout of the WX-1000 processor should be done in accordance with the procedures detailed in the WX-1000 Installation Manual.

This procedure will validate the installation and return to service of the SKY899.

3.2 CONTROLS

All operating controls are located on the front of the display. Figure 3-1 shows the locations of the controls. Complete operating instructions are provided in the SKY899 Pilot's Guide supplied with each system.

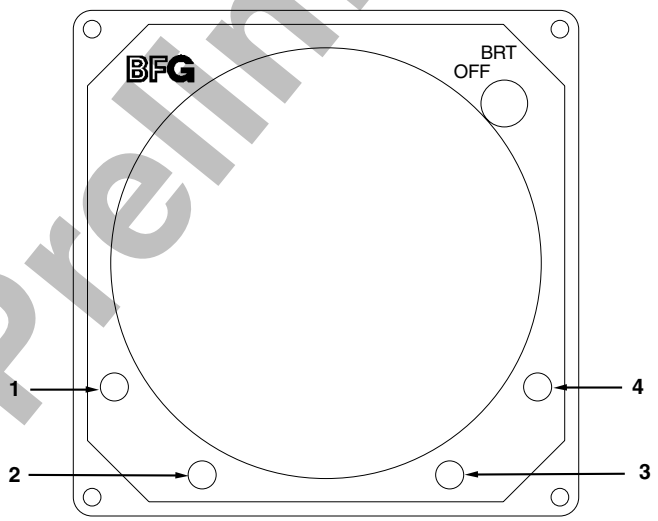


Figure 3-1. Controls

OFF/BRT Switch	Power is applied by rotating the knob clockwise past the detent. Continued clockwise rotation increases display brightness.
1, 2, 3, & 4 Pushbuttons	Also referred to as soft-keys (1), (2), (3), and (4). In every operating mode a label identifying the button function will be displayed next to the button.

3.3. CHECKOUT PROCEDURE

The TT391 Flightline Tester simulates both a ground based secondary surveillance radar (SSR) and an airborne transponder. With the SKY899 set to GROUND TEST (i.e., the barometric altimeter is simulated to 50,000 ft, heading simulated to 0 degrees, and the radar altimeter simulated to 2,500 ft) the TT391 will simulate two targets; a Traffic Advisory (i.e., a solid circle) at ¼ nm and Other Traffic (i.e., open diamond) at 4.5 nm. Both targets will be displayed in level flight at own aircraft altitude (i.e., "00" displayed above the traffic symbol).

If the indications given in the following procedure, except for the Flightline Tester, are not obtained, refer to the troubleshooting procedures in Chapter 4. If indications given for the Flightline Tester are not obtained, refer to the maintenance section of the TT391 Instruction Manual.

1. Make sure the aircraft's transponder is in the STBY mode and the DME is turned OFF. At the aircraft's instruments, verify all compass/HSI flags are valid. Verify all avionics equipment that is interfaced with the SKY899 (i.e., GPS, ADC, AHRS, encoding altimeter) are turned ON.

NOTE

After power up, it may take a couple of minutes for the altitude encoder to return a valid altitude to the transponder and SKY899.

2. Turn SKY899 ON. The display will show a start-up screen similar to one shown in figure 3-2. After start-up screen appears, rotate the OFF/BRT switch. Verify that clockwise rotation increases display brightness.

Figure 3-2. Start-up Screen

After approximately thirty seconds the display will show the STANDBY screen (see figure 3-3).

NOTE

If the TRC has not been calibrated to the directional antenna the display may show a “SKY899 FAILED” message. Calibration will be done during system setup.

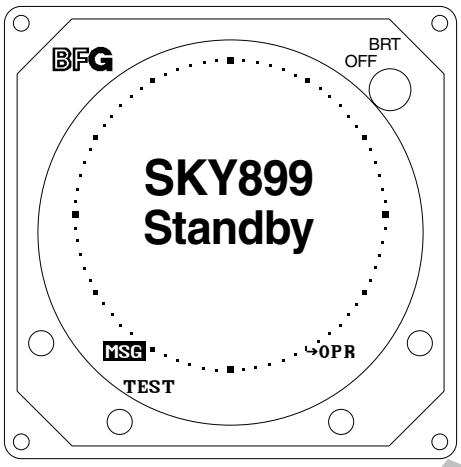


Figure 3-3. Standby Screen

3.3.1 System Setup

The system configuration can be done using the service menu or it can be downloaded with a previously saved configuration using the Compact Flash Card. Both setup procedures are described below and assume familiarity with service menu operation, see chapter 4 for operation information.

System Configuration (via Service Menu)

1. Turn SKY899 OFF and then enter the Service Menu (see paragraph 4.4) by holding the left two buttons (soft-keys 1 and 2) depressed as the system is turned ON.
2. From the Service Menu, select Setup and then select Aircraft Type. The Aircraft Type menu will appear, select correct aircraft type (fixed wing or rotorcraft). Select exit to return to setup menu.
3. From the Setup menu, select Antenna System:
    a. The Antenna System menu will appear, select correct antenna location (top or bottom).
    b. The antenna model menu will appear, select correct antenna model (NY164 or NY156).
    c. Verify Antenna location and model, then Select exit until you return to setup menu.

WARNING

Verify displayed antenna position matches antenna location on the aircraft (top or bottom). Failure to do so could give incorrect traffic bearing.

4. From the Setup menu, select Audio Level:
    a. The Audio Level menu will appear, set the desired audio level using the up and down selections (level is adjusted in 5% increments).
    b. Test the audio level by selecting Test. Verify the aural Traffic Traffic message is heard at a comfortable level, then Select exit to return to setup menu.
5. From the Setup menu, select Communication Ports:
    a. The Arinc 429 Receivers menu will appear, with all source avionics equipment turned on select autodetect. The Please wait... message will appear for approximately 20 seconds as the system configures the receiver channel, equipment type, and speed.

b. Verify receiver channels match desired wiring interface. If an interconnect error is discovered, correct wiring and then re-select autodetect. (To manually change individual receiver channels, highlight and select that channel. See see paragraph 4.4.1.4)

NOTES

1. It is possible for multiple data inputs (barometric altimeter, radio altimeter, magnetic heading and GPS navigation) from one source to be received on one channel (e.g., ARINC-429 superbus). Multiple data inputs will be indicated by the word Multi in the Arinc 429 Receiver Menu. (See see paragraph 4.4.1.4)
2. The data rate for RX channels 1 and 2 must be set to the same speed (12.5 or 100 kHz). The data rate for RX channels 3 and 4 must be set to the same speed (12.5 or 100 kHz). The data rate for channel 5 is independent of the other receivers. Channel 5 can be set to 12.5 or 100 kHz.

c. Select exit until you return to Setup Menu.

6. From the Setup menu, select Avionics Equipment:
   a. The Equipment menu will appear, select Browse All Avionics.

      The system will step you through each equipment sub-menu. As you select the equipment the next equipment menu in the loop will appear. Once you have stepped through all 8 sub-menus, the equipment menu will reappear.

   b. Verify the equipment shown in parentheses under each equipment title matches the wiring interface. To change equipment source, highlight and select it from the menu. (See see paragraph 4.4.1.5.)
   c. Select exit until you return to Service Menu.
   d. The Save or Revert menu will appear upon exiting setup menu. Select Save Changes to keep current configuration. (Selecting Revert to Old Settings will cause system to exit the service menu without saving changes.)
7. From the Service Menu, select Calibration:
   a. Select correct antenna location (top or bottom). The "SKY899 Antenna Calibration in Process..." message will appear. The Built In Test (BIT) signal phase will be calibrated for the TRC, cable connections, and antenna (see paragraph 4.4.3).
   b. Verify calibration passed: A new bit phase value is displayed and no error messages appeared.
   c. Press exit to return to Service Menu screen.
8. Perform system setup verification and operation procedure in paragraph 3.3.2.

Download System Configuration (via Compact Flash Card)

1. With the SKY899 OFF, lift the memory card door on the front of the TRC899 and insert the compact flash card into J12 connector.
2. Enter the Service Menu (see paragraph 4.4), select Configuration Management.
3. At the Configuration Management menu select Retrieve from CF. Verify the "download was successful" message is displayed. If an error occurs during download, the configuration setup must be done manually (see above "System Configuration" procedure).
4. Turn off the SKY899 and remove the compact flash card from J12 memory card connector.
5. Perform the system setup verification and operation procedure below (see paragraph 3.3.2) to verify configuration data was downloaded correctly.

3.3.2 System Setup Verification and Operation

1. Turn ON all avionics equipment interfaced to the SKY899.
2. From the Service Menu (see paragraph 4.4), select Information.
3. From the Information menu, select Data Monitor. The Data Monitors menu will appear.
4. Select each of the data monitors and verify the sensor information is correct (see paragraph 4.4.2.3):
   a. Change the status of the landing gear, squat switch, altitude, and heading sensors. Verify data monitors show the correct input changes (i.e., sensing of these signals).
   b. If the information is not correct, the sensor has failed to communicate with the TRC. Check operation of the sensor and connections between the TRC and sensor.
   c. Select exit until you return to the Service Menu.
5. From the Service Menu, select Ground Test (see paragraph 4.4.4).
6. From the Ground Test menu, select Perform Ground Test.
7. Verify operation of range function. Soft-key (3) is labeled to indicate the current range. Press soft-key (3) to toggle the display range between 2, 6 and 15 nm.
8. Select the 6 nautical mile range.
9. Verify that the system toggles through the altitude display modes. Soft-key (2) is labeled to indicate the current mode. Press Soft-key (2) to select normal (NRM), below (BLW), above (ABV), and unrestricted (UNR).
10. Select the NRM (normal) mode.
11. Position the aircraft with the nose aligned on any 90 degree heading. Avoid areas within 250 ft of obstructions (e.g., hangers, large aircraft, control towers, etc.) where there is a potential for multipath problems. Locate and mark test points at 30 degree intervals (i.e., 000, 030, 060, 090, 120, 150, 180, 210, 240, 270, 300, and 330 degrees) with respect to the directional antenna. Mark these points at the same distance, between 100 and 150 ft, from the aircraft.
12. Position the TT391 Flightline Tester on one of the test points identified in previous step.

CAUTION

The Flightline Tester is not weatherproof when the lid is open. Do not setup or operate the Flightline Tester in conditions of rain, sleet, etc.

13. Setup and verify operation of the TT391 Flightline Tester:
    a. Open the chassis lid and remove the lid from the chassis by sliding the lid off of the hinge pins (sliding it to the right). The lid "stay" must be removed from the lid before mounting. The stay will pop off of the lid. (The stay is the hinged part that props the lid open on the chassis).

NOTE

The Patch Antenna may be used without a tripod. The Patch Antenna can be held, or secured, and pointed towards the SKYWATCH HP aircraft under test WITH THE MOUNTING STUD POINT TOWARD THE GROUND. This orientation is critical.

    b. Mount the chassis lid, with the Patch Antenna facing the aircraft, onto a tripod (not included). The tripod must be capable of holding the antenna (approximately 2.5 lb) and must provide a standard base mounting stud threaded 1/4"-20. A typical tripod mount is shown in figure 3-4.

c. If the internal batteries are being utilized, proceed to sub-step f. If the Flightline Tester AC Converter Power Supply is to be utilized, proceed to sub-step d.

d. Connect the AC Converter Power Supply cable connector to the chassis external connector.

e. Connect the AC Converter Power Supply input power cable connector to one of the following AC sources:.
- 115 Vac, 60 Hz
- 115 Vac, 400 Hz

f. Set the Flightline Tester POWER switches to the ON position.

g. Verify that the LOW indicator is not steady on (it may flash). If the LOW indicator remains on (i.e., lit), perform one of the following three options.
- Use the AC Converter Power Supply to power the unit.
- Recharge the internal batteries.
- Replace the internal batteries.

h. Set the SELF-TEST switch to the 1030 position and verify that the 1030 indicator blinks on for 1/2 second every 5 seconds.

i. Set the SELF-TEST switch to the 1090 position and verify that the 1090 indicator blinks on for 1/2 second every 5 seconds.

j. Set SELF-TEST switch to center position (off). Set the POWER switch to the OFF position.

NOTE

Care should be taken to ensure that the Patch Antenna is connected to TT391 connector J1 and NOT J2. IF THE PATCH ANTENNA IS CONNECTED TO J2 THE TT391 WILL NOT FUNCTION CORRECTLY.

k. Connect the Flightline Tester coax cable to J3 on the Patch Antenna and to connector J1 in the chassis. (J2 should remain capped by the dust cover).

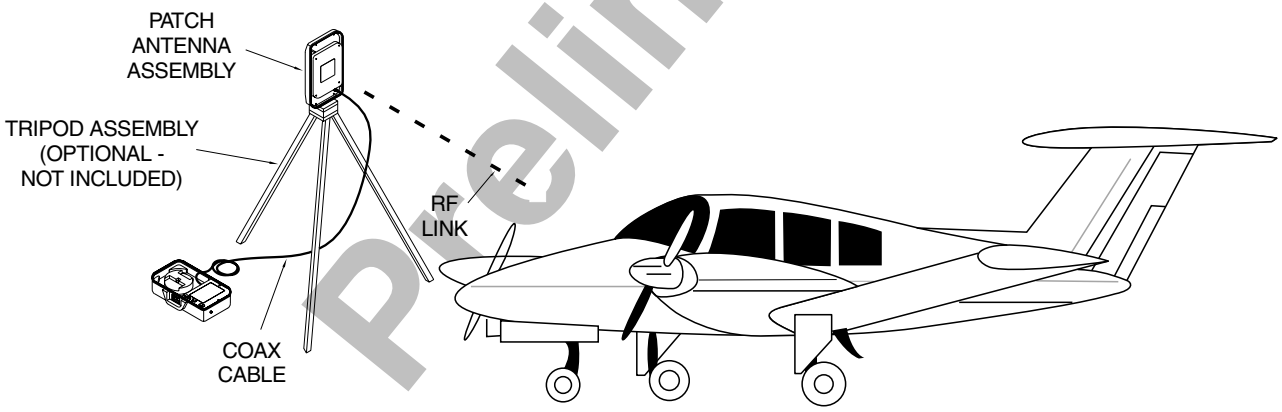


Figure 3-4. Typical Patch Antenna Tripod Mount

14. From each test point (see step 12):
    a. Position the TT391 Patch Antenna facing the SKYWATCH HP aircraft under test.
    b. Set the TT391 POWER switch to the ON position.
    c. Verify that the display shows, in the direction (± 30 degrees) of the TT391, two targets; a Traffic Advisory (i.e., a solid circle) at ¼ nm and Other Traffic (i.e., open diamond) at 4.5 nm. Both targets will be displayed in level flight at own aircraft altitude (i.e., "00" displayed above the traffic symbol).

NOTES

1. If the display reflects a gross error in target bearing, check the directional antenna cables at TRC connectors J9 (sum port) and J11 (difference port). They may be reversed. A further indication of this condition would be a target that moved in a counter-clockwise direction when the TT391 is moved in a clockwise direction.
2. Multiple targets or a faulty bearing may result from multipath distortion (see step 1).
3. During these tests, the SKY899 may detect and display other active targets.
4. To obtain a better line of sight, it may be necessary to elevate the patch antenna.

    d. Set the TT391 POWER switch to the OFF. Repeat procedure from each test point. Step 15 can be done from the last test point.

NOTE

To prevent SKYWATCH HP from tracking the movement of the test-set, it is necessary to set the TT391 POWER switch to OFF after completing each bearing measurement.

15. Return the TT391 assemblies to their position in the aluminum carrying case.
16. Restart SKY899 by cycling power OFF and then ON.
17. Connect an oscilloscope to the suppression bus and verify that the SKY899 suppression pulse (100 µs ±5 µs) exceeds +15 V dc. If less than +15 V dc the suppression bus is overloaded. Check all equipment connected to the bus. Repair/replace the offending device.
18. This completes the post installation checkout procedure.

3.4 SELF TEST

1. Turn SKY899 OFF and then:
    a. Make sure the aircraft's transponder is in the STANDBY, ON, or ALT mode.

NOTE

After power up, it may take a couple of minutes for the altitude encoder to return a valid altitude to the transponder and SKY899.

    b. If installed, power up the radio altimeter.
    c. Make sure all compass/HSI flags are cleared from the aircraft's instruments.
2. Turn SKY899 ON. The display should show a start-up screen similar to one shown in figure 3-2.

3. After approximately thirty seconds, observe the STANDBY screen and then press the TEST button (soft-key (2)).
4. The display should present a screen similar to that shown in figure 3-5.

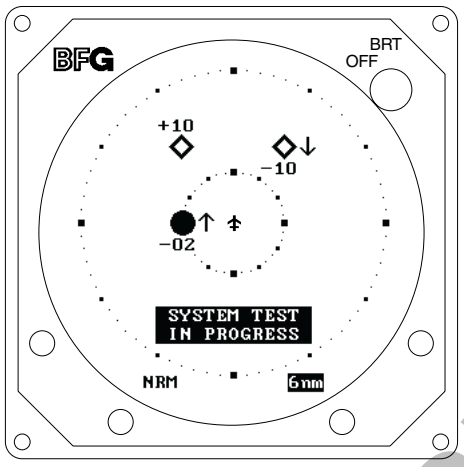


Figure 3-5. Self Test Screen

5. If the SKY899 passes the self-test, the system will return to the STANDBY screen (see figure 3-3) and the voice message, "SKYWATCH SYSTEM TEST PASSED," will be enunciated over the cockpit audio system.
6. If you do not hear the voice message or if the voice message is of insufficient volume:
   a. Check headphones/speaker and aircraft audio panel switch settings.

NOTE

Audio levels can be adjusted via the service menu and at the aircraft audio panel. There is no internal audio adjustment.

   b. Reset the audio level via the service menu (see paragraph 4.4.1.3).
   c. Check audio connection to the TRC:
      1) 600-ohm audio systems should be connected to P1-89 (AUDIO_H).
      2) 150-ohm audio systems should be connected to P1-90 (AUDIO_L).
      3) Audio common is connected to P1-91 (AUDIO_C).

NOTE

Audio output from the TRC is transformer isolated.

7. If SKY899 fails the self-test:
   a. The "SKY899 Failed" screen with an error message indicating the type of failure will be displayed.
   b. The voice message, "SKYWATCH SYSTEM TEST FAILED", will be enunciated over the cockpit audio system.
   c. To re-test, press TEST button soft-key (2).
   d. Refer to the fault isolation procedures in Chapter 4.

CHAPTER 4
MAINTENANCE

4.1 INTRODUCTION

This chapter contains general flight-line maintenance and troubleshooting procedures for installations interfaced to WX-1000/SKY497 display or an alternate display. Removal of components is on condition of failure. Troubleshooting is intended to aid in isolating failures to a defective assembly. Each time the TRC, directional antenna, or directional antenna cables (including connectors) are replaced, the TRC must be calibrated to the directional antenna (refer to paragraph 4.4.3).

4.2 CONTINUED AIRWORTHINESS

No scheduled maintenance is required to ensure continued airworthiness.

4.3 PERIODIC MAINTENANCE

At regular inspection intervals, do the periodic maintenance procedures of paragraph 4.3.1 thru 4.3.3.

4.3.1 WX-1000/SKY497 Display

1. Check that indicator cable is properly mated and secured.
2. Check to ensure unit is properly placed and secured to the instrument panel.

CAUTION

Do not use cleaning solvents on the viewing face.

3. Check face-plate for cleanliness. Wipe the viewing face with a damp lint-free, static-free cloth. If necessary, clean with a soft cloth moistened with a mild solution of soap and water. Take care to prevent cleaning solution from running down inside the case.

4.3.2 TRC

1. Check that connectors are properly mated and secure.
2. Check to ensure that the hold-down knobs on the mounting tray are secured to the TRC.

4.3.3 Antenna

1. Check for dents, cracks, and punctures.

CAUTION

Do not paint the antennas.
Do not use cleaning solvents on the antennas.

2. Remove all dirt and grease from surface areas. Clean with a soft cloth moistened with mild soap and water.
3. Visually inspect sealant around the antenna base. Reapply sealant if required.

4.4 SERVICE MENU

The Service Menu is intended as an aid in installing, testing and troubleshooting the SKY899 (figure 4-2). The Service Menu is not intended to be used by the pilot during normal system operation. A service menu tree is provided at the end of this paragraph (figure 4-3). When interfaced to an alternate display the service menu functions are accessed via a computer (figure 4-1) using a terminal emulation program, see appendix E for operating instructions. To access the service menu from the terminal emulation program, type the menu command and then type the corresponding prefix for each selection (e.g., 1, 2, x, etc.).

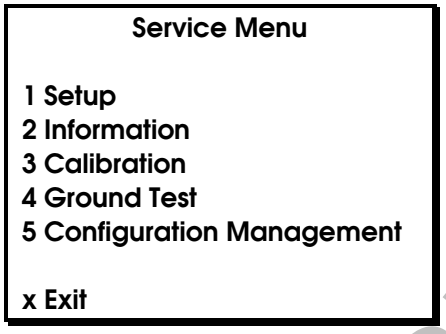


Figure 4-1. Service Menu (Terminal Emulation Program)

Access the Service Menu on a WX-1000/SKY497 display by holding soft-keys (1) and (2) (the left two buttons) depressed as the system is turned on. Hold the buttons until the Service Menu is displayed. The Service Menu is shown in figure 4-2.

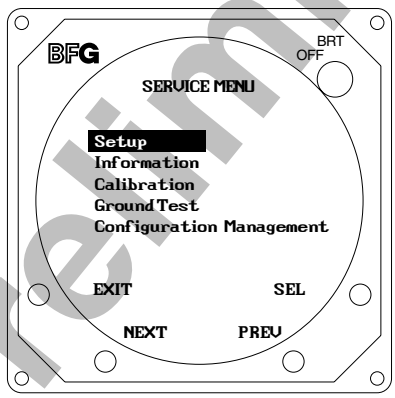


Figure 4-2. Service Menu (WX-1000/SKY497 Display)

Ground Test is available only if squat switch input indicates aircraft is on the ground.

The buttons perform the following operations:

EXIT - backs up one screen (if in service menu screen it will exit and enter normal/standby mode).
NEXT - scrolls to the next item.
SEL - selects the highlighted item.
PREV - scrolls to the previous item.

The individual menu items are explained in the following paragraphs.

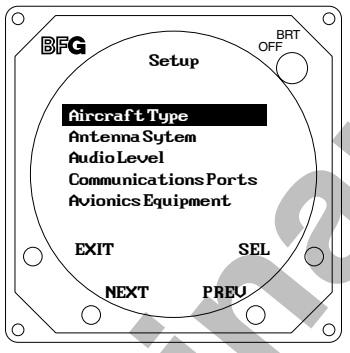
NOTE

Service Menu screens are shown for documentation purposes only. Each system may be configured differently and live data will correspond to the sensors installed in a particular aircraft.

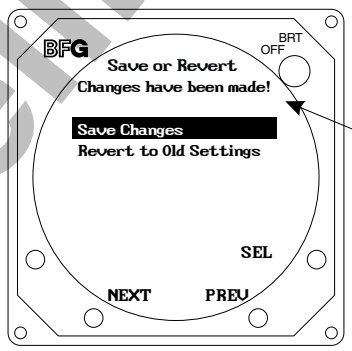
4.4.1 Setup

The setup menu configures the SKY899 system to your specific installation. Setup covers the aircraft type, antenna system, audio level, communication ports, and avionics equipment. Setup can be accessed by selecting it in the service menu screen.

The Setup menu provides the following choices:



The following menu will appear when you exit the setup menu if changes were made in the system configuration. Save changes will store configuration settings in system configuration module. Revert to old settings will restore the system configuration back to the last saved configuration.

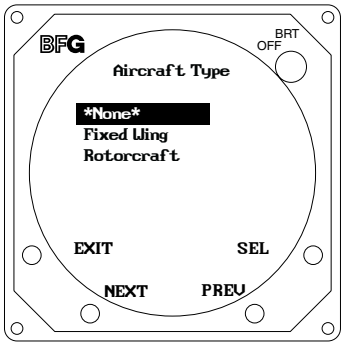


Each setup item is covered in the following paragraphs.

4.4.1.1 Aircraft Type

The aircraft type menu allows you to choose between fixed wing or rotorcraft aircraft.

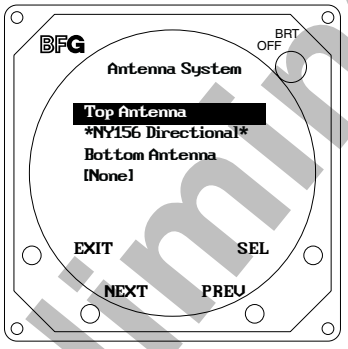
The Aircraft Type menu provides the following choices:



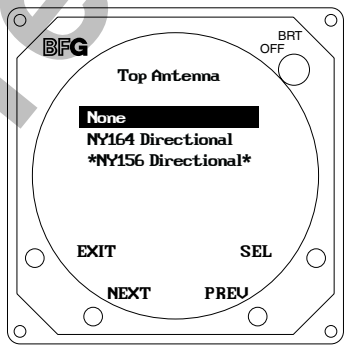
4.4.1.2 Antenna System

The SKY899 allows you to install the antenna on top or bottom of aircraft and can use the NY156 (TCAS I installation) or NY164 antenna. Only one antenna location can be selected, when choosing an antenna location the other location will automatically be set to "None."

The Antenna System menu provides the following choices:



Selecting Top Antenna (or Bottom Antenna) provides the following choices:

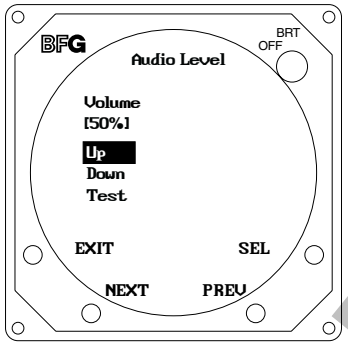


(Bottom Antenna menu is same as Top Antenna menu)

4.4.1.3 Audio Level

The audio level menu allows you to set and test the audio level output. Audio level range is 0 to 40 mW into 600 Ohm load, indicated by percentage (0-100%). Audio level can be adjusted up or down in 5% increments. Selecting test will cause the "traffic traffic" aural message to be annunciated over the aircraft audio system.

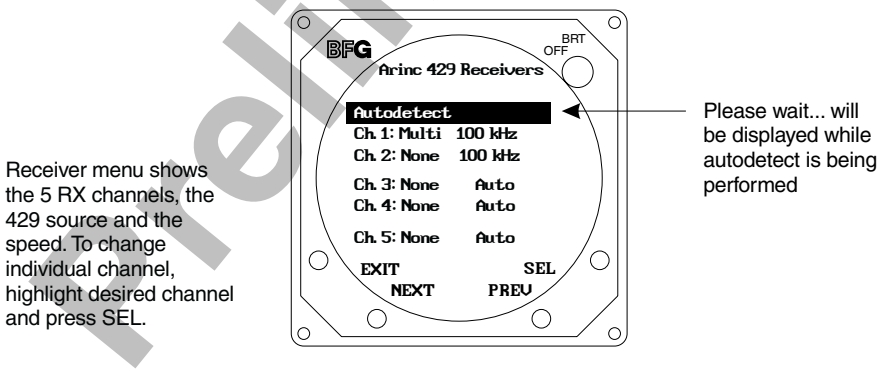
The Audio Level menu provides the following choices:



4.4.1.4 Communication Ports

Configuring the communication ports should be done before configuring the avionics equipment. Select Communication Ports from the Setup menu, the ARINC 429 receiver menu will be displayed. With all avionics equipment turned on, you can set the speed and the equipment type for each channel automatically (Autodetect) or individually. Autodetect is recommended to configure the ARINC 429 receiver's, however you can manually select the equipment type and speed for each individual channel.

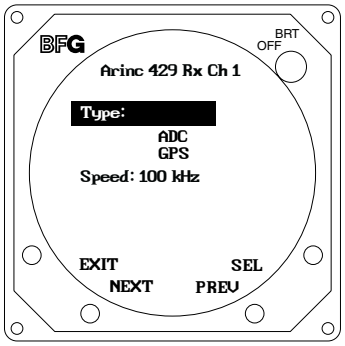
Selecting Communication Ports from the Setup menu will cause the ARINC 429 Receivers menu to appear:



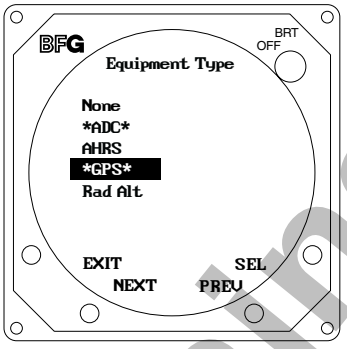
NOTES

1. The data rate for RX channels 1 and 2 must be set to the same speed (12.5 or 100 kHz).
2. The data rate for RX channels 3 and 4 must be set to the same speed (12.5 or 100 kHz).
3. The data rate for channel 5 is independent of the other receivers. Channel 5 can be set to 12.5 or 100 kHz.

Selecting any channel (ch.1 thru ch.5) will cause that individual Rx channel menu to appear:

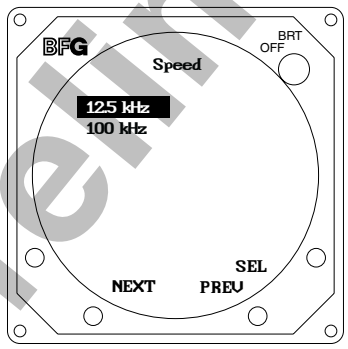


Selecting Type will cause the Equipment Type menu to appear:



More than one source can be selected for each 429 RX channel. Each selected source will have an asterisk's before and after it. If more than one source is selected the word "Multi" will appear in the ARINC 429 Receivers menu.

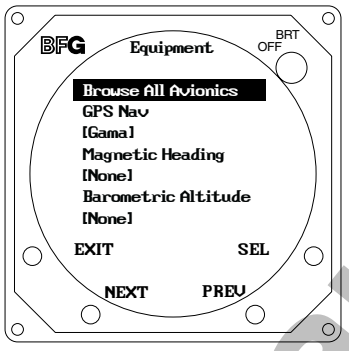
Selecting Speed will cause the Speed menu to appear:



4.4.1.5 Avionics Equipment

Avionics equipment menu allows you to set the source equipment interfaced to SKY899 and sets discrete inputs. With all of the avionics turned on in the aircraft select Browse All Avionics from the avionics equipment menu. This will sequentially step you through the setup of all avionics equipment interfaces. After completing Browse All Avionics selections, corrections can be made by selecting the individual items from the Equipment menu.

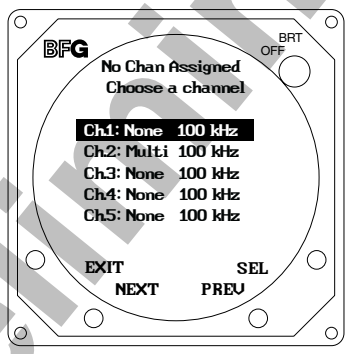
The Avionics Equipment menu provides the following choices:



Using Next button to scroll down will cause these additional menu choices to appear one at a time.

Radio Altitude
[None]
Landing Gear
[None]
Weight-On-Wheels
[None]
Audio Suppression
[None]
External Display
[None]

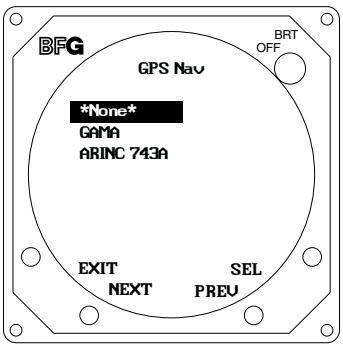
If ARINC-429 equipment is selected in the avionics equipment menu, but was not configured in the communications port menu the following menu will appear:



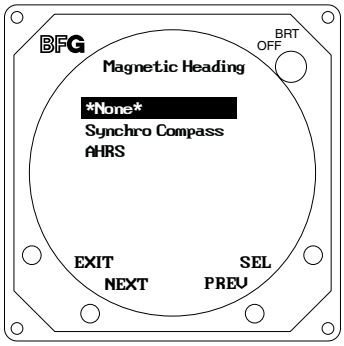
This Menu appears when ARINC 429 equipment has been selected, but was not assigned to a channel via the Communication Ports Menu

The Avionics Equipment sub-menus are as follows.

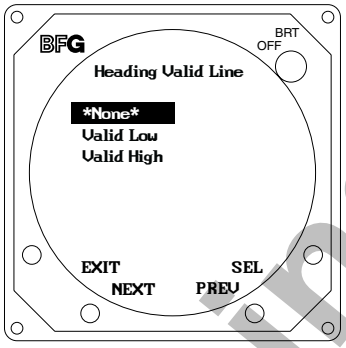
The GPS Nav menu provides the following choices:



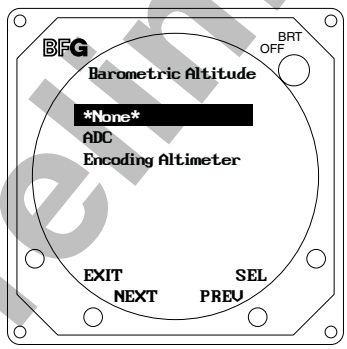
The Magnetic Heading menu provides the following choices:



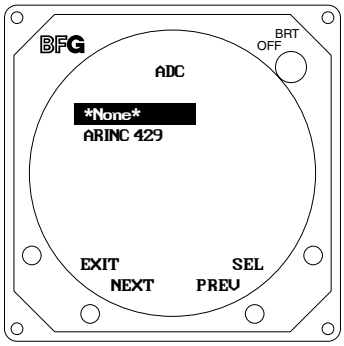
Selecting Synchro Compass causes Heading Valid Line menu to appear:



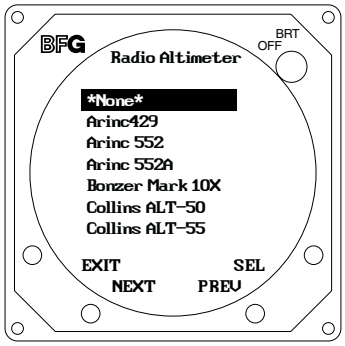
The Barometric Altitude menu provides the following choices:



Selecting ADC will cause the ADC menu to appear:



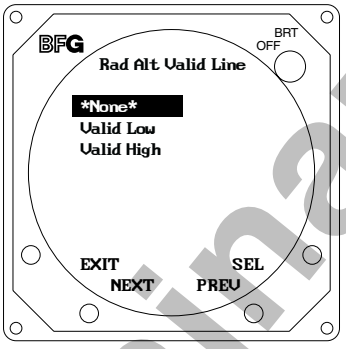
The Radio Altimeter menu provides the following choices:



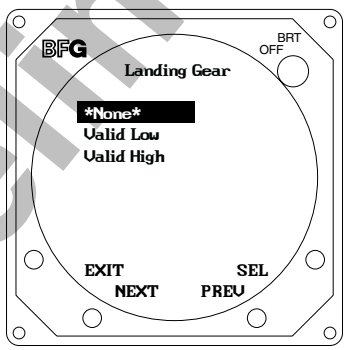
Using Next button to scroll down will cause these additional menu choices to appear one at a time.

King KRA10/10A
King KRA 405
Sperry AA-100
Terra TRA 3000

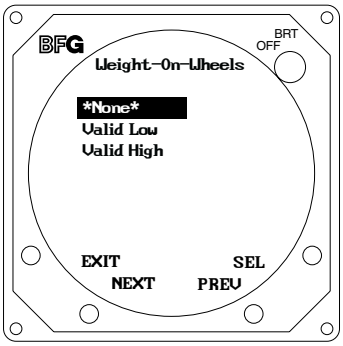
Selecting a DC analog radio altimeter will cause Rad Alt Valid Line menu to appear:



The Landing Gear menu provides the following choices:



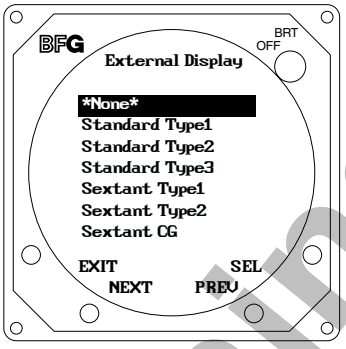
The Weight-On-Wheels (squat switch) menu provides the following choices:



The Audio Suppression menu provides the following choices:

The External Display menu provides the following choices:

If a WX-1000/SKY497 display is installed and an external display driver is selected the WX-1000/SKY497 display ranges are slaved to the external display driver (i.e., display range settings are controlled by the alternate display driver). Refer to table 2-2 for display drivers and ranges.



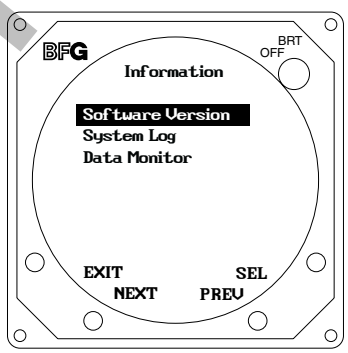
Using Next button to scroll down will cause these additional menu choices to appear one at a time.

Forestry Serv
Collins EFIS Type1

4.4.2 Information

The information screens contain a record of software versions, system (error) log and real-time sensor data (data monitor). If you have problems with the SKY899 record the software versions, the error messages, and then verify the Data Monitor screens match Service Menu selections and the wiring diagrams (figures 2-2 thru 2-4). Have this information available when contacting Field Service Engineering. The field service engineer must have adequate information to diagnose a problem. Select Information from the Service Menu to access the following menus.

The Information menu provides the following choices:



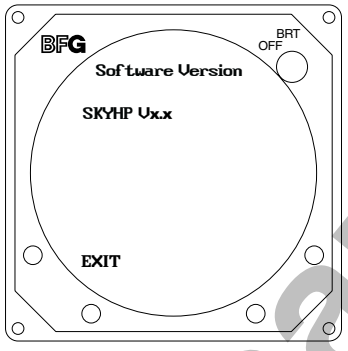
4.4.2.1.Software Version

Select Software Version menu to display the overall system software version.

NOTE

The software version identified on the TRC serial number tag represents the system software revision and is a combination of the software/firmware installed within the TRC. The software version displayed in this menu may not match the software version (system revision) identified on the serial number tag.

The Software Version menu displays the following:



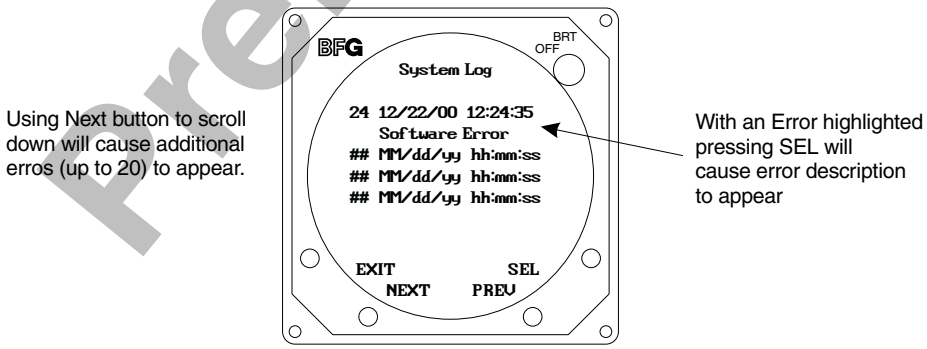
4.4.2.2 System Log

The 20 most recent errors detected by the system self-test are saved in the System Log. For each error, the corresponding error code, date and run-time of occurrence are saved. The system log is displayed by selecting that option from the Information Menu.

NOTE

Tables 4-2 and 4-3 provide a list and description of each error code (see paragraph 4.6 error messages).

The System Log displays the results in the following format:



where:

##	=	Error code.
MM:dd:yy	=	Date (month, day and year)
hh:mm:ss	=	Run-time (in hours, minutes and seconds) when error occurred.

If the System Log is empty, the following message is displayed:

NO FAULTS DETECTED

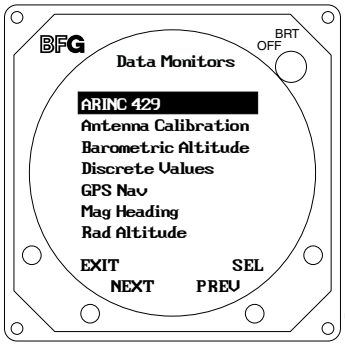
If, due to a failure of non-volatile memory, the System Log cannot be displayed, the following message is displayed:

DATA NOT AVAILABLE

4.4.2.3 Data Monitor

The data monitor menu consists of 7 data monitors. All data is real-time and is updated to the screen once per second.

The Data Monitor menu provides the following choices:



NOTE

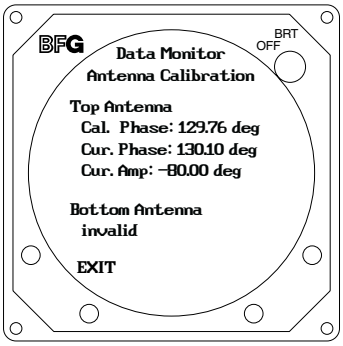
Values displayed on the Data Monitor are continuously updated. The sensor source is read at power-up or whenever a configuration change has been saved. You can change the sensor source, save it and have the data monitor reflect the change without cycling power to the system. This will help in troubleshooting installation problems.

The ARINC 429 Receivers Data Monitor screen displays the following:

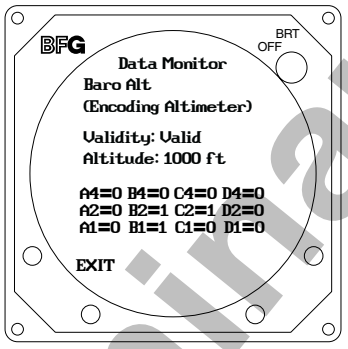
Parity display is the count of bad parities received. If the number is continuing to increase that is typically a sign of bad data being received.

If you have a parity of 0 then valid data is being received.

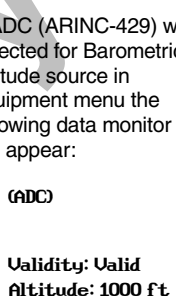
The Antenna Calibration Data Monitor screen displays the following:



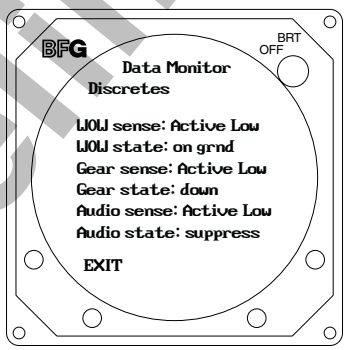
The Barometric Altitude Data Monitor screen displays the following:



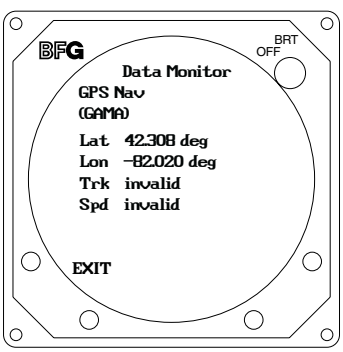
If ADC (ARINC-429) was selected for Barometric Altitude source in equipment menu the following data monitor will appear:



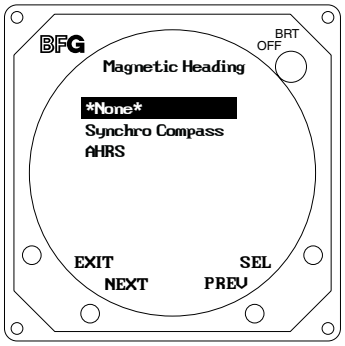
The Discrete Values Data Monitor screen displays the following:



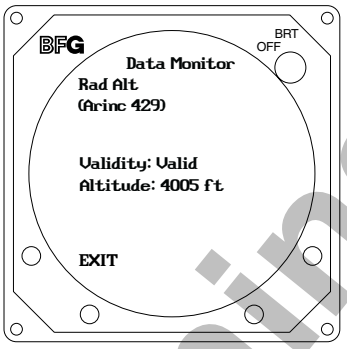
The GPS Nav Data Monitor screen displays the following:



The Mag Heading Data Monitor screen displays the following:



The Rad Alt Data Monitor screen displays the following:



If DC Analog Radio Altimeter was selected in equipment menu the following data monitor will appear:

(Bonzer Mark 10X)

Sense: Active Low
Validity: Valid
Altitude: 39 ft

4.4.3 Calibration

NOTE

Ensure transponder is in standby while doing calibration.

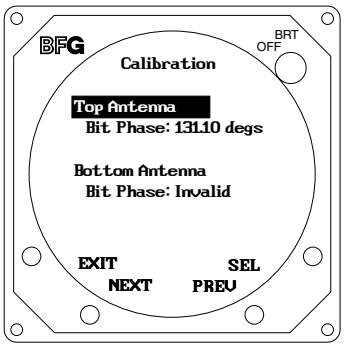
Each time the TRC, directional antenna, or any of the directional antenna cables (including connectors) have been repaired or replaced the TRC must be calibrated. Calibration is accessed from the Service Menu (i.e., press SEL with Calibration highlighted). The calibration screen shows the current calibration value of each antenna. Since only one antenna location (top or bottom) can be used the antenna location not configured will have an invalid bit phase message.

NOTE

If the TRC has never been calibrated, the current calibration value will be displayed as 999.

The Calibration menu provides the following choices:

The message SKY899 Antenna Calibration in Process... will be displayed while calibration is being performed.



After a successful calibration, the new Bit Phase value will be displayed.

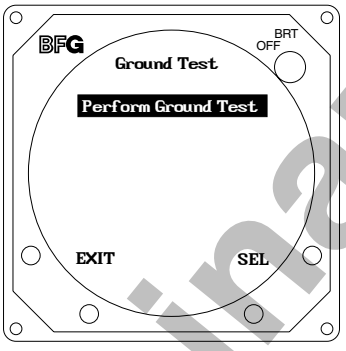
The calibration value (000-359) is derived from a variety of measurements. Specific values are meaningless however, in a failed TRC, a varying spread may indicate problems with the directional antenna system (antenna, cables, or connectors) or the TRC.

If the calibration failed, the message "Calibration Failed!" will be displayed.

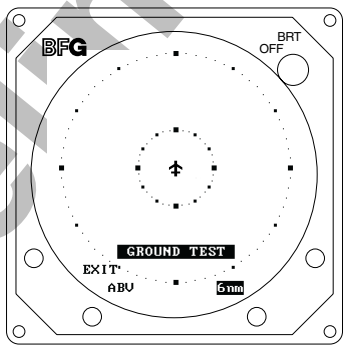
4.4.4. Ground Test

Ground Test initializes the system for on-the-ground testing. In this configuration, the barometric altimeter is simulated to 50,000 ft, heading simulated to 0 degrees, and the radar altimeter simulated to 2,500 ft. Ground test menu is accessed by selecting that option from the Service Menu (i.e., press SEL with Ground Test highlighted).

The Ground Test screen displays the following:



Selecting Perform Ground Test initializes the ground test software and displays the following:



NOTES

1. When the system is set to GROUND TEST, the barometric altimeter is simulated to 50,000 ft and the heading simulated to 0 degrees.
2. Ground test is available only if the squat switch input indicates aircraft is on the ground.
3. When the system is set to GROUND TEST, the radio altimeter simulated to 2,500 ft.

The buttons perform the following operations in this mode:

EXIT - causes the system to return to the Information Menu.

Soft-key (2) - toggles the system through the above (ABV), normal (NRM), below (BLW), and unrestricted (UNR) altitude display modes. It is labeled to indicate current mode (i.e., ABV, NRM, or BLW).

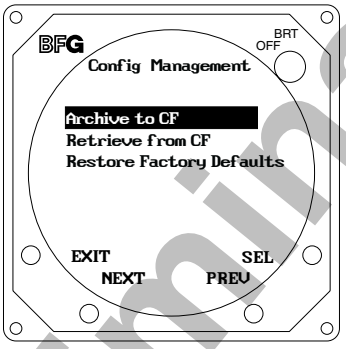
Soft-key (3) - toggles the display range between 2, 6 and 15nm. It is labeled to indicate current range (i.e., 2nm, 6nm or 15nm).

Soft-key (4) - is not used.

4.4.5 Configuration Management

Configuration Management menu allows you to save system configuration to a compact flash, retrieve system configuration from a compact flash, or restore system configuration to factory defaults. To access configuration management, select it from the Service Menu.

The Configuration Management screen displays the following:



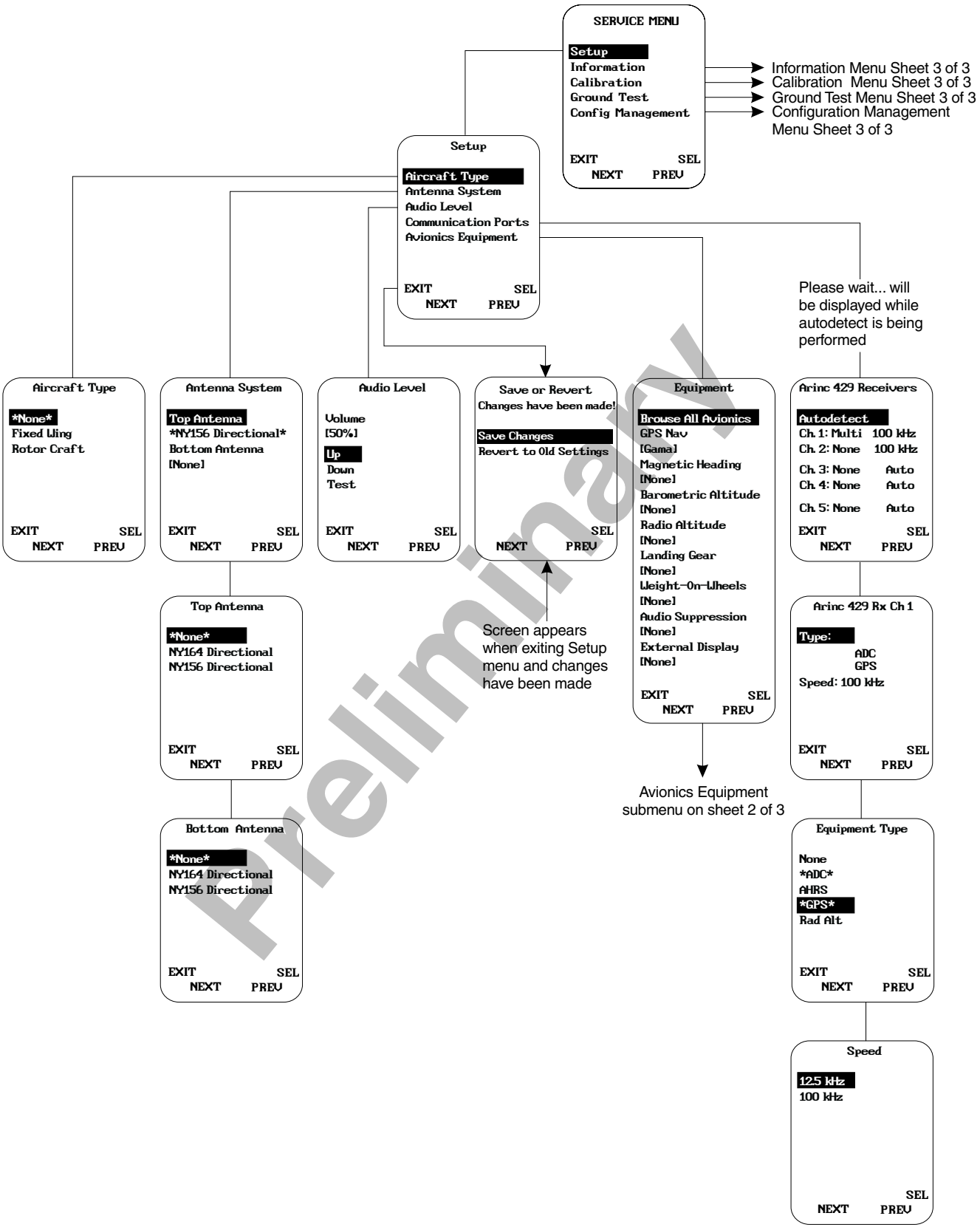


Figure 4-3. Service Menu Tree (Sheet 1 of 3)

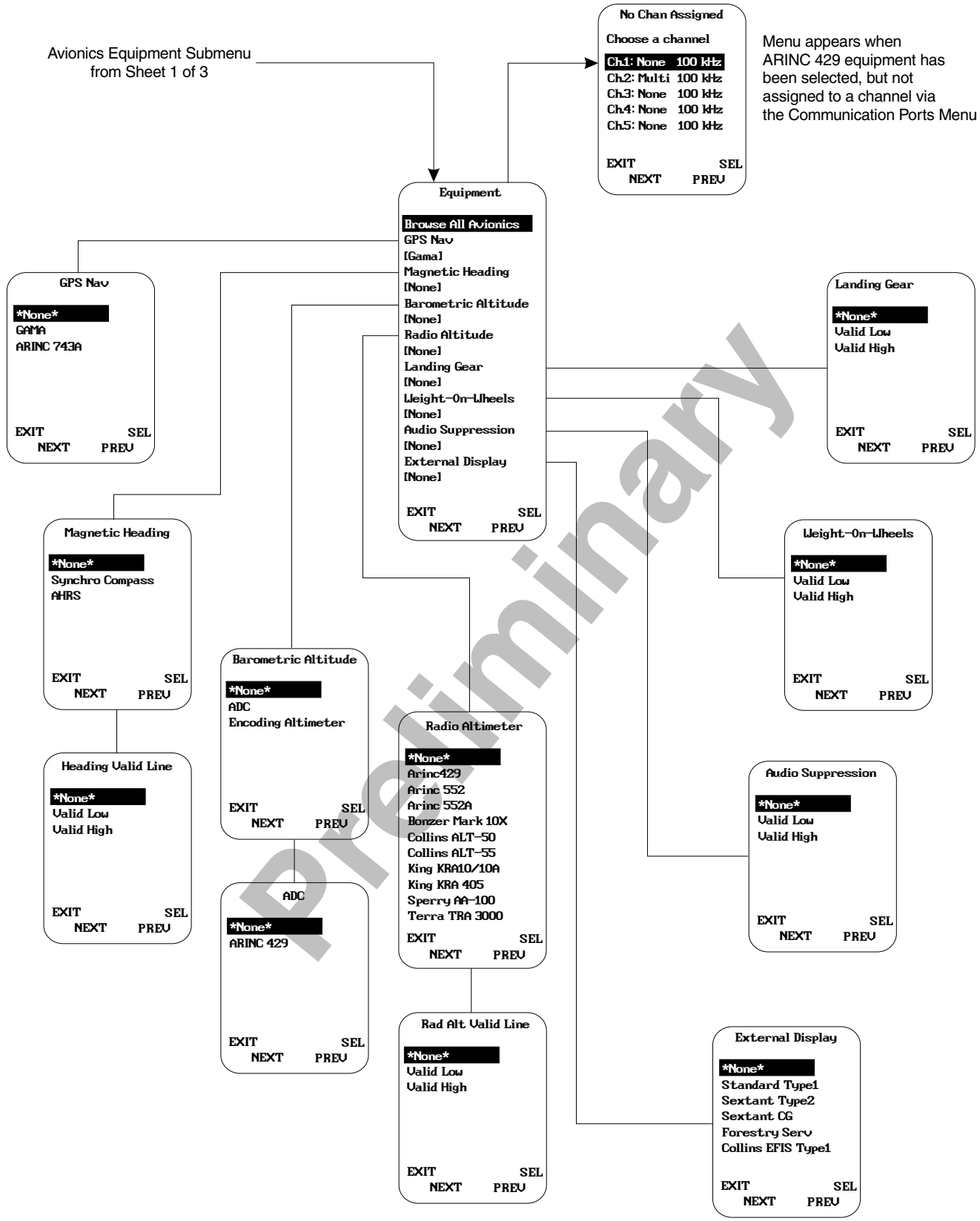


Figure 4-3. Service Menu Tree (Sheet 2 of 3)

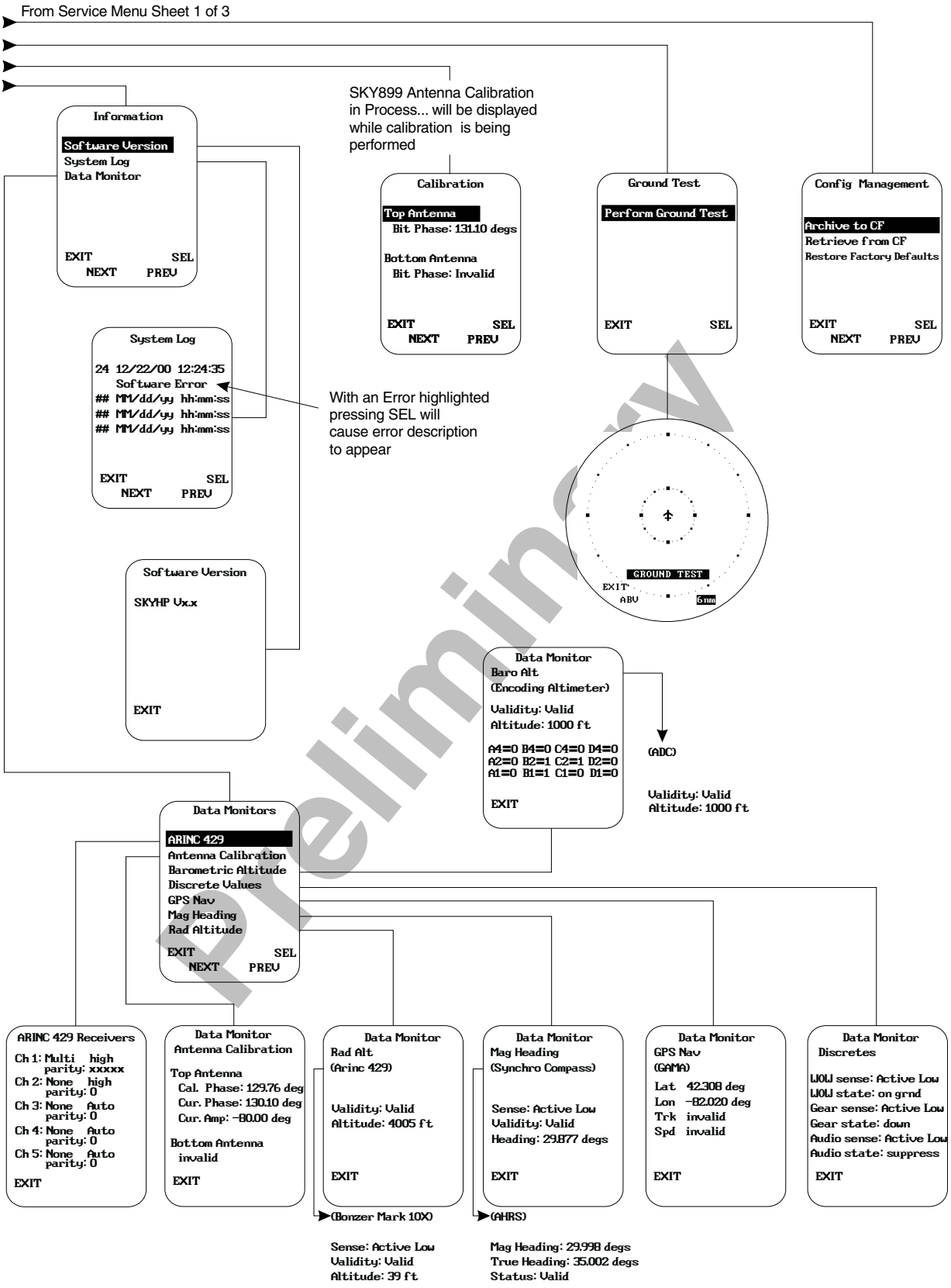


Figure 4-3. Service Menu Tree (Sheet 3 of 3)

4.5 TROUBLESHOOTING

Table 4-1 is intended to assist trained electronic technicians to determine which assembly is inoperative. Do the corrective action steps in the order described. Use the Service Menu (refer to paragraph 4.4) as an aid in fault isolation. Information available from the service menu can help identify conditions that need to be resolved. If interfaced to an alternate display service menu must be accessed via an RS-232 terminal device, see Appendix E for operating instructions.

Table 4-1. Fault Isolation

SYMPTOM	CORRECTIVE ACTION
Display remains dark after SKY899 is powered ON.	a. Check position of the WX-1000 maintenance switch (NORMAL/OVERRIDE). b. Reset circuit breaker if it is tripped. c. Check aircraft power source. d. Check connection to WX-1000 processor, if installed. e. Check power input at TRC mating connector. P8-A +28V (18 - 32 V dc PWR) P8-B +28V_RET (AIRCRAFT PWR RETURN) f. Check cables connected to display. g. Replace Display.
Display is distorted.	Check for interference from aircraft systems.
Incorrect response to buttons (soft-keys).	Check soft-key wiring inside display cable and WX-1000 processor cable (if installed).
SKY899 will not enter service menu.	a. Check soft-key wiring. b. If using an alternate display device the soft-key's needed for accessing service menu from the WX-1000/SKY497 display are not connected. c. If using an alternate display service menu must be accessed with an RS-232 terminal device by typing the menu command. (Appendix E)
The self-test successfully completes without audio annunciation.	a. Check headphones/speaker and aircraft audio panel switch settings. b. Check volume level and run audio test in service menu. c. Check cables connected to TRC. Audio Alert Output: P1-89 (AUDIO_H - 600-Ohm) P1-90 (AUDIO_L - 150-Ohm) P1-91 (AUDIO_C - Common)
SKY899 Failed.	a. Check system log (para 4.4.2) for errors. Error messages are detailed in para 4.6. b. Replace TRC.
Self-test does not execute. Aircraft is on the ground.	a. If standby screen is displayed, check soft-key wiring inside display cable and WX-1000 processor cable (if installed). b. Check squat switch connection to the TRC and the weight-on-wheels configuration in service menu. Squat Switch Input: P1-24
The display cannot be switched between SKY899 and the WX-1000. Both systems are installed.	a. Check circuit breakers. Reset if tripped. b. Check position of the WX-1000 maintenance switch (SW2). It should be set to the NORMAL position. c. Check wiring of the SKYWATCH/*Stormscope* display mode switch (para 2.7.3 and figure 2-2).
WX-1000 processor has been removed for service; SKY899 fails to operate.	Check position of the WX-1000 maintenance switch (NORMAL/OVERRIDE). When the WX-1000 has been removed for service, it should be set to the OVERRIDE position. This switch may be located in the avionics bay.

Table 4-1. Fault Isolation (Continued)

SYMPTOM	CORRECTIVE ACTION
SKY899 paints itself as a target (e.g., TA).	a. Verify suppression bus shielded cable is grounded correctly at both ends. b. Connect an oscilloscope to the suppression bus and verify that the SKY899 suppression pulse (100 µs ±5 µs) exceeds +15 V dc. c. If less than +15 V dc, the suppression bus is overloaded. d. Check all equipment connected to the bus. e. Repair/replace the offending device.
SKY899 TRC899 has been removed for service; the WX-1000 *Stormscope* fails to operate.	Check the adapter plug (see para 4.7). If the TRC899 is removed for service, an adapter plug is required to permit continued operation of the WX-1000.

4.6 ERROR MESSAGES

SKY899 firmware is designed to generate error messages associated with a particular condition or step in the program. The 20 most recent errors detected by the system are saved in the System Log (see para 4.4.2.2). For your convenience, in table 4-2, we have listed the error messages that have been associated with SKY899 installations. Where appropriate, procedures that may assist in resolving installation problems are provided. When a severe error occurs SKY899 will fail.

Table 4-2. Installation Related Error Messages

ERROR NO.	MESSAGE	REMARKS
ERROR 06	I2C Bus Error	a. Configuration module is present, however the BUS communication (SDA or SCL) is incorrect check associated wiring. b. Replace TRC. c. Replace configuration module.
ERROR 07	Config Module Error	a. Configuration module is not found check associated wiring. b. Replace TRC. c. Replace configuration module.
ERROR 10	Compact Flash Error	a. Unable to read the compact flash information correctly, verify compact flash is inserted into J12 correctly. b. Try a different compact flash. c. Replace TRC.
ERROR 14	RF Amplitude Error	a. Check directional antenna and associated cables. b. Calibrate directional antenna (para 4.4.3) **NOTE** Ensure transponder is in standby and DME is OFF while doing calibration c. Cycle power and run pilot initiated self-test.
ERROR 15	RF Angle Error	a. Check directional antenna and associated cables. b. Calibrate directional antenna (para 4.4.3) **NOTE** Ensure transponder is in standby and DME is OFF while doing calibration c. Cycle power and run pilot initiated self-test.
ERROR 17	Mag Var Table Error	a. Unable to read the compact flash information correctly, verify compact flash is inserted into J12 correctly. b. Try a different compact flash. c. Replace TRC.

Table 4-2. Installation Related Error Messages (Continued)

ERROR NO.	MESSAGE	REMARKS
ERROR 20	Barometric Input Error	a. Check altimeter source. Is the unit turned on and been given enough time to warm up. b. Cycle power. c. Ensure that barometric altitude input is from only one source (gilham code or ARINC-429). d. Encoded inputs can be checked from the barometric altimeter data monitor screen (para 4.4.2.3). e. Using the service menu, verify barometric source configuration and altitude information (para 4.4.2.3). f. Check wiring associated with altimeter source.
ERROR 21	GPS Input Error	a. Check GPS source is it turned on and locked onto satellites. b. Using the service menu, verify configuration (speed and equipment type) is set correctly. c. Check ARINC-429 wiring associated with GPS.
ERROR 22	Heading Input Error	No heading input being received (ARINC-429 or synchro compass). a. Check heading source. b. Using the service menu, verify heading setup in Mag Heading data monitor (para 4.4.2.3). c. If the heading signals become valid, the system will recover automatically. d. Check wiring associated with heading input.
ERROR 23	Synchro Input Error	Invalid synchro compass input (XYZ signals or 400 Hz reference). a. Check heading source. b. Using the service menu, verify heading setup in mag heading data monitor (para 4.4.2.3). c. If the heading signals become valid, the system will recover automatically. d. Check wiring associated with synchro compass input.
ERROR 29	System Config Error	a. SKY899 requires a barometric altitude input in order to operate. Verify a source has been selected in service menu. b. Check wiring associated with configuration module if error reoccurs replace configuration module.

The error messages in table 4-3 are used by factory technicians in determining what actions may have preceded a system failure. These messages do not necessarily indicate a current system failure and are provided for information only. Should the installer observe these messages in the error log without a SKY899 Failed message during normal operation, no service action is required.

Table 4-3. Informational Error Messages

ERROR NO.	MESSAGE	ERROR NO.	MESSAGE
ERROR 01	Boot Error	ERROR 16	Antenna Sel. Unit Error
ERROR 02	ROM Memory Error	ERROR 18	ARINC 429 Comm Error
ERROR 03	RAM Memory Error	ERROR 19	Serial Comm Error
ERROR 04	Watchdog Error	ERROR 24	Software Error
ERROR 05	Bus Fault Error	ERROR 25	Operating Sys Error
ERROR 08	Unused Interrupt Error	ERROR 26	Video Controller Error
ERROR 09	I/O Board Error	ERROR 27	Video Memory Error
ERROR 11	Power Supply Error	ERROR 28	NVRAM Error
ERROR 12	RF Failure Error	ERROR 30	System Test Error
ERROR 13	RF Transmitter Error		

4.7 TRC899/WX-1000 ADAPTER PLUG

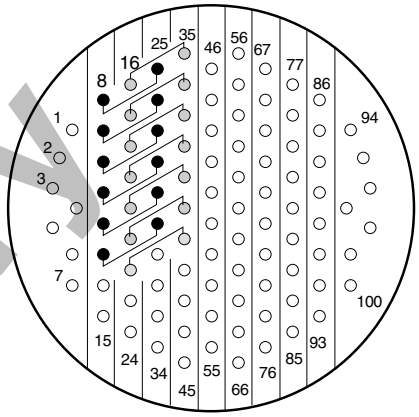
An adapter plug can be used to by-pass SKY899 *only* if a WX-1000 *Stormscope* system is installed. The adapter will permit continued operation of the WX-1000 if the TRC899 is removed for service. It can also be used as a troubleshooting tool when attempting to isolate a problem to either or both systems.

The adapter plug mates with P1. It can be purchased from BFGoodrich Avionics Systems (P/N 805-11910-001) or fabricated locally from the details provided in figure 4-4.

ADAPTER PLUG CONNECTIONS

JUMPER PINS		FUNCTION
8	25	DPWR+15
9	26	DPWR-15
10	27	DSPLY_GND
11	28	HSYNC_+
12	29	HSYNC_-
13	30	VSYNC_+
22	41	VSYNC_-
16	35	VIDEO_+
17	36	VIDEO_-
18	37	SFTKEY1
19	38	SFTKEY2
20	39	SFTKEY3
21	40	SFTKEY4

PIN INSERT VIEW



ADAPTER PLUG JUMPER INSTALLATION

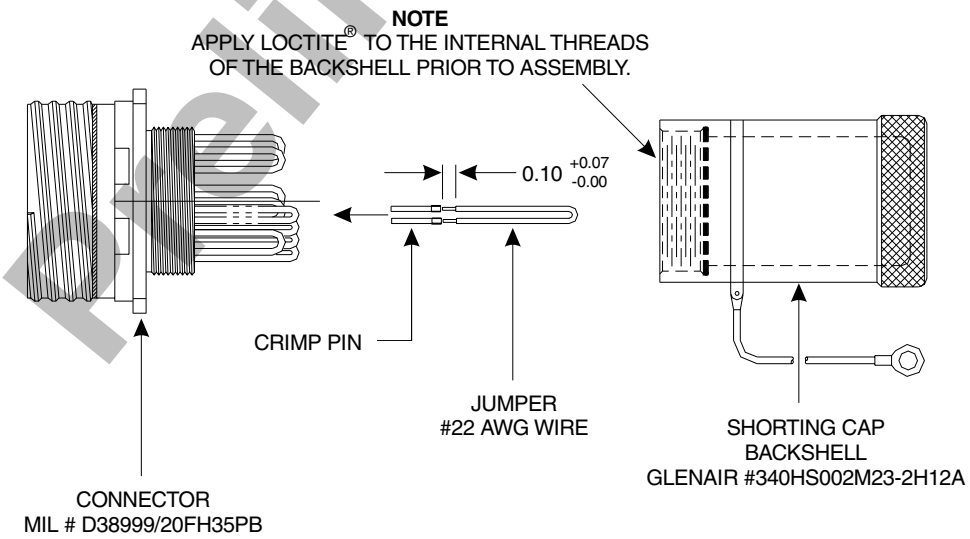


Figure 4-4. Adapter Plug Assembly

4.8 DISPOSITION OF FAILED ITEMS

Return defective components to your authorized BFG Avionics Systems dealer or to::

BFG Avionics Systems
Attn: Customer Service
5353 52nd Street, S.E.
Grand Rapids, MI USA 49512

If available, pack components in their original shipping container. If the original container is not available, pack them as follows:

CAUTION

Do not use desiccant crystals when packaging electronic assemblies. Since the assembly must be packed tightly, crystals in bag form cannot be used. The use of loose crystals may cause unnecessary damage resulting in a cleaning problem.

1. Ensure that nonconductive covers/caps are installed on the exposed terminals of cable connectors on the display, TRC, and antenna.
2. The display and TRC contain electrostatic discharge sensitive (ESDS) parts and must be wrapped in static protective materials.
3. Wrap with bubble pack. Secure bubble pack with reinforced tape.
4. Place assembly in a cardboard box.
5. Wrap any accessories in tissue and place in the box. Fill spaces with bubble pack.
6. Put a letter on top of bubble pack. The letter must contain:
    - Your name, address, and telephone number.
    - Purchase order number.
    - Description of component including, when applicable, model and serial number.
    - Date of purchase.
    - A brief description of the difficulty.
    - Type of display and radar altimeter.
    - Copy of error log, if available.
7. Shut box and seal with reinforced tape.
8. Attach packing list to outside of box.

APPENDIX A
SKY899 INTERFACE
SIGNAL & CABLE CHARACTERISTICS

A.1 INTRODUCTION

This appendix defines the electrical characteristics of all input/output signals to the TRC899 and the labels for the ARINC-429 data bus. Sufficient data is included to perform an electrical load analysis for the aircraft. The interface characteristics contained in this appendix are fully compatible with ARINC specifications where noted. Connection information identifies connector-pin and signal names as they appear on interconnect wiring diagram, figure A-1 shows P1 connector pin locations and signal names.

NOTE

External isolation diodes are not required and SHOULD NOT be installed.

A.2 ELECTRICAL CHARACTERISTICS

SIGNAL	CHARACTERISTICS
Altitude (Gilham Code) / Encoding Altimeter Input	These uncorrected barometric signals are Gilham code (or gray code) inputs coming from an airdata computer or encoding altimeter (see paragraph 2.11). These 11 lines may be connected in parallel with the aircraft transponder. If the aircraft is equipped with selectable altitude encoders, connect the altitude inputs so that SKY899 is always connected to the selected encoder. (Reference ARINC 572-1.)

NOTES

1. Only one altimeter input source (gray code or ARINC-429, not both) should be connected. The altimeter input should be from the same source that is interfaced with the transponder or at least as accurate as that source, i.e., ± 125 ft.
2. If the aircraft has switched encoders that use 28V RETURN or AIRCRAFT GROUND as reference for encoder selection, then ALT_COMMON (P1-72) should be left unconnected.
3. If altitude D2 is not used P1-70 should remain unconnected.

CONNECTION	Connector-Pin	Signal Name
	P1-56	ALT_A1
	P1-57	ALT_A2
	P1-58	ALT_A4
	P1-59	ALT_B1
	P1-60	ALT_B2
	P1-61	ALT_B4
	P1-67	ALT_C1
	P1-68	ALT_C2
	P1-69	ALT_C4
	P1-70	ALT_D2
	P1-71	ALT_D4
	P1-72	ALT_COMN
CABLE	Minimum 22 AWG wire for lengths up to 30 ft.	
VOLTAGE	+30 V input max.	
CURRENT	<1 mA sourced per line.	
FREQUENCY	<100 Hz	
SOURCE Z	>10 kΩ per line.	
MAX CAPACITANCE	<20 pF per line.	

SIGNAL	CHARACTERISTICS
Antenna	Top Directional SUM (SIGMA) Port (Blue) CONNECTION — Connector: J9 - TNC; Signal Name: SUM CABLE — Cable attenuation must not exceed 2.5 dB, VSWR 1.5:1. Refer to paragraph 2.6.1. Impedance: 50 Ω
Antenna	Top Directional BIT PROBE Port (Black) CONNECTION — Connector: J10 - BNC; Signal Name: BIT CABLE — Cable attenuation must not exceed 6 dB, VSWR 1.5:1. Refer to paragraph 2.6.1. Impedance: 50 Ω
Antenna	Top Directional DIFFERENCE (DELTA) Port (Red) CONNECTION — Connector: J11 - TNC; Signal Name: DIFFERENCE CABLE — Cable attenuation must not exceed 2.5 dB, VSWR 1.5:1. Refer to paragraph 2.6.1. Impedance: 50 Ω
ARINC-429 External Interface	The SKY899 has seven ARINC-429 receivers and three transmitter (paragraph 2.9). Four of the channels are paired internally and can operate at either low speed (12.5 kHz) or high speed (100 kHz). However, the paired channels must be set to the same speed (see tables A-1 and A-2). The transmitters operate only at high speed (100 kHz). The first ARINC-429 transmitter (A429TX1) is intended to provide the capability to interface with alternate display device. The second and third ARINC-429 transmitters (A429TX2 & TX3) are a future option. Five of the ARINC-429 receivers can be used to input data from other avionics systems. The sixth and seventh receivers are not used at this time (future option).

NOTES

1. The radio altimeter must provide full range output between 0 and 2500 feet. Not all altimeters provide this full range output. The full range output can sometimes be obtained as a mod to the radio altimeter . Check with the specific altimeter manufacturer for compatibility and availability of modification, if necessary.
2. The TRC can accept Radio Altimeter input from ARINC-429 or DC analog source. The Barometric Altitude can be ARINC-429 or Gilham Code. The Magnetic Heading can be ARINC-429 or Synchro (XYZ). Select only one source for each aircraft input.
3. If 429 barometric altitude is used, it should be from the same source that is interfaced with the transponder or it must be at least as accurate as that source, i.e., ± 125 ft.
4. Receive channels 1 and 2 must be set to the same speed (12.5 or 100 kHz). Receive channels 3 and 4 must be set to the same speed (12.5 or 100 kHz). Channel 5 is independent of the other receivers and can be to 12.5 or 100 kHz.

SIGNAL	CHARACTERISTICS			
ARINC-429 External Interface (Continued)	CONNECTION	Connector-Pin	Signal Name	
		P1-54	A429RX1_A	Ch. 1 line A
		P1-55	A429RX1_B	Ch. 1 line B
		P1-62	A429RX2_A	Ch. 2 Line A
		P1-63	A429RX2_B	Ch. 2 Line B
		P1-64	A429RX3_A	Ch. 3 Line A
		P1-65	A429RX3_B	Ch. 3 Line B
		P1-73	A429RX4_A	Ch. 4 Line A
		P1-74	A429RX4_B	Ch. 4 Line B
		P1-75	A429RX5_A	Ch. 5 Line A
		P1-76	A429RX5_B	Ch. 5 Line B
		P1-83	A429RX7_A	Ch. 7 Line A
		P1-84	A429RX7_B	Ch. 7 Line B
		P1-81	A429RX8_A	Ch. 8 Line A
		P1-82	A429RX8_B	Ch. 8 Line B
		P1-42	A429TX1_A	Ch. 1 Line A
		P1-43	A429TX1_B	Ch. 1 Line B
		P1-44	A429TX2_A	Ch. 2 Line A
		P1-45	A429TX2_B	Ch. 2 Line B
		P1-52	A429TX3_A	Ch. 3 Line A
		P1-53	A429TX3_B	Ch. 3 Line B
Audio (Alert) Output (see paragraph 2.10).	This output is directly compatible with industry standard audio panels			

NOTE

Audio output from the TRC is transformer isolated.

This output is disabled when a terrain warning alarm is detected (see paragraph 2.7.1)

CONNECTION	Connector-Pin	Signal Name
	P1-89	(AUDIO_H) - 600 Ω
	P1-90	(AUDIO_L) - 150 Ω
	P1-91	(AUDIO_C) Audio Common
CABLE	Minimum 22 AWG twisted shielded pair cable for lengths up to 30 ft.	
POWER	40 mW into a 600 Ω load. Audio level is adjustable via service menu.	
FREQUENCY	0 - 3.0 kHz	
LOAD Z	Selectable 150 or 600 Ω	

Audio Inhibit (Terrain Warning System - GPWS)

This input senses a terrain warning alarm and temporarily disables the SKY899 audible alert messages until the warning clears (see paragraph 2.7.1).

The input can be either a constant flag signal or an alternating flag output. The flag must be cleared for five (5) seconds before the TRC accepts a "NO ALARM" condition and restores audible alerts. IF THE AIRCRAFT IS NOT EQUIPPED WITH TERRAIN WARNING SYSTEM, LEAVE THIS INPUT UNCONNECTED.

NOTE

If the aircraft is equipped with terrain warning system (GPWS), it must be connected to the TRC.

SIGNAL	CHARACTERISTICS

CONNECTION — Connector-Pin: P1-34 — Signal Name: (GPWS)
CABLE: Minimum 22 AWG wire for lengths up to 30 ft.
VOLTAGE: WARNING: 0 V dc to +2.5 V dc (Aircraft Ground).
NO WARNING: +9 V dc to +30 V dc or open.
CURRENT: <5 mA sourced.

Debug Port

NO CONNECTION TO EXISTING AIRCRAFT WIRING. The Debug Port (RS-232) is used for laptop interface to support system setup, post installation checkout and troubleshooting. The port defaults to the following settings:

Baud Rate 19,200
Parity: None
Data Bits 8
Stop Bits 1
No handshaking

CONNECTION	Connector-Pin	Signal Name
	J7-2	DIAG_RX
	J7-3	DIAG_TX
	J7-5	DIAG_GND
	J7-7	CTS
	J7-8	RTS

Heading Input (XYZ Synchro)

These connections from the aircraft heading source (ARINC 407 & 407-1 Synchro System Manual) allow the unit to rotate the displayed data as the aircraft turns. See Heading Flag in this appendix for flag input specifications.

X(S1), Y(S3), Z(S2)
FREQUENCY Min: 50 Hz
Max: 1500 Hz
VOLTAGE
Min: 5.0 V ac rms (w/reduced angular resolution.)
Max: 14.0 V ac rms (external padding required for higher levels.)
INPUT IMPEDANCE >50 kΩ

CONNECTION	Connector-Pin	Signal Name
	P1-46	HEADING_X
	P1-47	HEADING_Y
	P1-48	HEADING_Z

CABLE See paragraph 2.6.4.

H and C (high and low reference)
FREQUENCY Min: 50 Hz
Max: 1500 Hz Spec says 400 Hz ±20%
VOLTAGE Min: 3 V ac rms
Max: 35 V ac rms
INPUT IMPEDANCE >50 kΩ

CONNECTION	Connector-Pin	Signal Name
	P1-49	HEADING_H
	P1-50	HEADING_C

CABLE See paragraph 2.6.4.

SIGNAL	CHARACTERISTICS
Heading Valid	Indicates that the heading source is providing valid heading information. The status of the heading valid signal can be none, active high, or active low and must be selected during system setup via the service menu.

CONNECTION	Connector-Pin	Signal Name
	P1-51	HEADING_FLG
CABLE	See paragraph 2.6.4.	
VOLTAGE	None: Open or no connection	
	Active Low: (ref. to aircraft ground)	
	Valid: -5 V dc to +2.5 V dc	
	Invalid: +9 V dc to +32 V dc	
	Active High: (ref. to aircraft ground)	
	Valid: +9 V dc to +32 V dc	
	Invalid: -5 V dc to +2.5 V dc	
INPUT IMPEDANCE	>2 kΩ	
INPUT CURRENT	Active: Min: 1 mA	
	Max: 15 mA	

Horizontal Sync

Balanced horizontal sync from the WX-1000 Processor (if installed) and output to the WX-1000/SKY497 display. Signal levels as specified in RS-422.

CONNECTION	Connector-Pin	Signal Name
	P1-28	(HSYNC_IN+) From Processor
	P1-29	(HSYNC_IN-) From Processor
	P1-11	(HSYNC_OUT-) To Display
CABLE	See paragraph 2.6.7.	
VOLTAGE	0-5 V dc	
CURRENT	<100 mA	
FREQUENCY	16.4 kHz	
LOAD Z	1 kΩ	

Lamp Outputs (above and below)

External annunciators are required when using an alternate display that is not capable of displaying above and below vertical modes. Outputs are switched to ground when active. The lamps require a separate dc source (constant or dimming circuit). If lamp voltage is an ac source then an isolation relay must be used.

Depending on the vertical display mode selected the appropriate annunciator will light. If in normal vertical display mode neither lamp will light, if in above mode the ABV lamp will light, if in below mode then the BLW lamp will light, and when unrestricted vertical mode is selected both lamps will light.

CONNECTION	Connector-Pin	Signal Name
	P1-66	LP1OUT - (ABV)
	P1-85	LP2OUT - (BLW)
CABLE	Minimum 22 AWG wire for lengths up to 30 ft.	
VOLTAGE	ON: 0 V dc or Ground	
	OFF: Maximum +32 V dc or open	
CURRENT	Maximum current 300 mA.	

SIGNAL	CHARACTERISTICS

Operational mode

Operational mode output can drive a lamp annunciating when the system is in operational mode. (See lamp outputs above for characteristics.)

CONNECTION	Connector-Pin	Signal Name
	P1-31	OPER_MODE
CABLE	Minimum 22 AWG wire for lengths up to 30 ft.	
VOLTAGE	ON: 0 V dc or Ground	
	OFF: Maximum +32 V dc or open	
CURRENT	Maximum current 300 mA.	

Landing Gear Switch Input

This signal line is to be connected to the landing gear switch to sense the position of the landing gear (fixed, up or down, see paragraph 2.7.2). The state of the switch can be active low or active high in reference to aircraft ground. The switch status can be fixed, active low or active high, this is selected via service menu.

IF THE AIRCRAFT DOES NOT HAVE A LANDING GEAR SWITCH, THIS INPUT MUST REMAIN UNCONNECTED. With this configuration, if no ARINC 429 compatible radio altimeter is installed, the system will default to the highest TA sensitivity level (level B) and audio TA announcements (i.e., "traffic, traffic") will not be inhibited during takeoff and landing.

CONNECTION	Connector-Pin	Signal Name
	P1-33	GEAR
CABLE	Minimum 22 AWG wire for lengths up to 30 ft.	
VOLTAGE	Fixed: Open or no connection	
	Active Low: (ref. to aircraft ground)	
	Valid: -5 V dc to +2.5 V dc	
	Invalid: +9 V dc to +32 V dc	
	Active High: (ref. to aircraft ground)	
	Valid: +9 V dc to +32 V dc	
	Invalid: -5 V dc to +2.5 V dc	
CURRENT	<5 mA sourced.	
SOURCE Z	>40 kΩ	
MAX CAPACITANCE	<20 pF	

ON/OFF Power (SW2)

This input turns the TRC on and off. (See paragraph 2.7.5.) When an alternate display is installed a separate switch is required, any general purpose SPDT toggle switch capable of 3A @ 28 V dc can be used.

When a WX-1000 processor is connected to with a SKY899 a maintenance over-ride switch is necessary to enable the SKY899 to be powered-up if the WX-1000 processor has been removed for service. During normal operation, with a WX-1000 processor installed, SW2 should remain in the WX-1000 position. Any general purpose DPDT toggle switch can be used.

CONNECTION	Connector-Pin	Signal Name
	P1-4	ON/OFF
	P1-5	ON/OFF_RET
CABLE	Minimun 22 AWG.	
VOLTAGE	Less than 0.7 V = ON; open = OFF.	
CURRENT	<100 mA	

SIGNAL	CHARACTERISTICS

Operational Mode Output (optional)

Operational mode output can drive a lamp annunciating when the system is in operational mode. Output is switched to ground when system is in operation mode. The lamp requires a separate dc source (constant or dimming circuit). If lamp voltage is an ac source then an isolation relay must be used.

CONNECTION	Connector-Pin	Signal Name
	P1-31	OPER_MODE
CABLE	Minimum 22 AWG wire for lengths up to 30 ft.	
VOLTAGE	ON: 0 V dc or Ground	
	OFF: Maximum +32 V dc or open	
CURRENT	Maximum current 300 mA.	

Power Input (TRC)

18-32 V dc. A 5 A circuit breaker is required (see paragraph 2.16).

CONNECTION	Connector-Pin	Signal Name
	P8-A	+28V
	P8-B	+28V_RET
CABLE	Use twisted shielded pair cable (Beldon 83322, Alpha 2826/2, or equivalent). Terminate shield to airframe at sensor or power source.	
VOLTAGE	18 to 32 V dc, 70 Watts (Maximum)	

Radio Altimeter (Analog)

This interface allows a DC analog radio altimeter to be used to monitor own aircraft height above ground and includes input for radio altitude valid signal. Some analog radio altimeters utilize a discrete valid/invalid signal line to indicate radio altitude validity, while others set the analog data input line to a high out-of-range value for invalid altitude conditions. If a discrete flag signal is not available leave RADIOALT_FLG (P1-14) unconnected.

CONNECTION	Connector-Pin	Signal Name
	P1-6	RAD_ALT_IN_HI
	P1-7	RAD_ALT_IN_LO
	P1-14	RAD_ALT_FLG

SKYWATCH/STORMSCOPE (SW1)

If a WX-1000 processor is installed, this signal (SW1 on the Interconnect wiring diagram, figure 2-3) switches the display between the WX-1000 and SKY899. Any general purpose SPST toggle switch can be used.

CONNECTION	Connector-Pin	Signal Name
	P1-15	SMS
	P1-23	SMS_RET
CABLE	Minimum 22 AWG.	
VOLTAGE	CLOSED (< 0.7 V dc) = *Stormscope* display mode	
	OPEN = SKYWATCH display mode.	
CURRENT	<100 mA	

SIGNAL	CHARACTERISTICS
Soft-keys	Soft-key inputs from the WX-1000/SKY497 display and output to the WX-1000 processor (if installed). The pushbuttons on the front of the display are referred to as soft-keys (**1**), (**2**), (**3**), and (**4**). In every operating mode a label identifying the button function is displayed next to the button. When using an alternate display device refer to manufacturer instructions concerning these connections. Use of soft-key inputs will depend upon the alternate display capabilities.

	Connector-Pin	Signal Name	
CONNECTION	P1-18	$\overline{\text{SFTKEY1\_IN}}$	From Display
	P1-19	$\overline{\text{SFTKEY2\_IN}}$	From Display
	P1-20	$\overline{\text{SFTKEY3\_IN}}$	From Display
	P1-21	$\overline{\text{SFTKEY4\_IN}}$	From Display
	P1-37	$\overline{\text{SFTKEY1\_OUT}}$	To Processor
	P1-38	$\overline{\text{SFTKEY2\_OUT}}$	To Processor
	P1-39	$\overline{\text{SFTKEY3\_OUT}}$	To Processor
	P1-40	$\overline{\text{SFTKEY3\_OUT}}$	To Processor

CABLE: See paragraph 2.6.7

VOLTAGE:
- Active: Min: 0.0 V, Max: 1.5 V
- Inactive: Min: 3.5 V or Open (Internal 4.7 kΩ pull-up), Max: 5.0 V

Squat Switch Input (Weight-On-Wheels)

This signal line is to be connected to the squat switch to sense when the aircraft is on the ground (see paragraph 2.7.4). The state of the switch can be active low or active high in reference to aircraft ground. The switch status can be none, active low or active high, this is selected via service menu.

If a squat switch is not installed on the aircraft, it is recommended to install a switch, which will enhance system operation.

	Connector-Pin	Signal Name
CONNECTION	P1-24	SQUAT

CABLE: Minimum 22 AWG wire for lengths up to 30 ft.

VOLTAGE:
- None: Open or no connection
- Active Low: (ref. to aircraft ground)
  - Valid: -5 V dc to +2.5 V dc
  - Invalid: +9 V dc to +32 V dc
- Active High: (ref. to aircraft ground)
  - Valid: +9 V dc to +32 V dc
  - Invalid: -5 V dc to +2.5 V dc

CURRENT: <5 mA sourced.

SIGNAL	CHARACTERISTICS

Suppression Bus I/O

The SKY899 outputs a 100 µs (± 5 µs) suppression pulse on the aircraft suppression bus (see paragraph 2.20). In addition, the SKY899 receives suppression signals from all other devices on the suppression bus (e.g., transponder, DME). (Reference ARINC 735-2 and DO-197A.)

CAUTION

The aircraft transponder must have suppression circuitry to ensure that SKYWATCH HP does not paint itself as a target (e.g., TA).

CONNECTION	Connector-Pin	Signal Name
	P1-93	SUPBUS
CABLE	Any size low capacitance shielded cable may be used.	
VOLTAGE	18 - 70 V dc input, greater than 20 V dc output.	
CURRENT	0.3 A output max.	
FREQUENCY	ATCRBS - 100 µs ± 5 µs output Mode S - 70 µs ±1 µs output DC-1 MHz input.	
SOURCE Z	2 kΩ	
LOAD Z	10.5 kΩ	
MAX CAPACITANCE	<50 pF	

System Configuration Module

The configuration module (i.e., personality plug) is used to store aircraft installation dependent information. Aircraft specific information is selected via the service menu, typically during system setup. Once the setup settings have been saved the system configuration will stay with the aircraft wiring allowing the TRC to be replaced or exchanged without having to re-configure the TRC. When powered up the configuration information is sent to the TRC via the bi-directional serial data bus (SDA). The configuration module is located inside backshell of P1 connector. See paragraph 2.21.

CONNECTION	Connector-Pin	Signal Name
	P1-2	3.3V
	P1-92	PLUG_GND
	P1-99	SDA
	P1-100	SCL
CABLE	Minimum 22 AWG wire for lengths up to 30 ft.	
VOLTAGE	??????????????	

Vertical Sync

Balanced vertical sync from the WX-1000 Processor (if installed) and output to the display. Signal levels as specified in RS-422.

CONNECTION	Connector-Pin	Signal Name
	P1-30	VSYNC_IN+ From Processor
	P1-41	VSYNC_IN- From Processor
	P1-13	VSYNC_OUT+ To Display
	P1-22	VSYNC_OUT- To Display
CABLE	See paragraph 2.6.7	
VOLTAGE	0-5 V dc	
FREQUENCY	60 Hz	
SOURCE Z	1 kΩ	

SIGNAL	CHARACTERISTICS

Video Output

Balanced video from the WX-1000 Processor (if installed) and output to the display. Signal levels as specified in RS-422 specification.

CONNECTION	Connector-Pin	Signal Name
	P1-35	VIDEO_IN+ From Processor
	P1-36	VIDEO_IN- From Processor
	P1-16	VIDEO_OUT+ To Display
	P1-17	VIDEO_OUT- To Display
CABLE	See paragraph 2.6.7	
VOLTAGE	0-5 V dc	
CURRENT	<100 mA	
FREQUENCY	<15 MHz	
LOAD Z	1 kΩ	

WX-1000/SKY497 Display Power

Power supply to WX-1000/SKY497 display. +15/-15 V dc from the Display WX-1000 Processor (if installed) and output to the display.

CONNECTION	Connector-Pin	Signal Name
	P1-25	DPWR+15_IN From Proc.
	P1-26	DPWR-15_IN From Proc.
	P1-27	DSPLY_GND_IN From Proc.
	P1-8	DPWR+15_OUT To Display
	P1-9	DPWR-15_OUT To Display
	P1-10	DSPLY_GND_OUT To Display
CABLE	See paragraph 2.6.7	
VOLTAGE	+15/-15 V dc	
CURRENT	0.7 A input max.	

Future Options

The following connections are reserved for future use. THESE PINS MUST REMAIN UNCONNECTED.

CONNECTION	Connector-Pin	Signal Name
	P1-1	+5 V
	P1-3	-15 V
	P1-32	DI02
	P1-77	RS422_TXA
	P1-78	RS422_TXB
	P1-79	RS422_RXA
	P1-80	RS422_RXB
	P1-86	RS232_TX2
	P1-87	RS232_RX2
	P1-88	RX232_GND2

SIGNAL NAME	PINS	SIGNAL NAME	PINS
+5V	P1-01	HEADING_FLG	P1-51
3.3V	P1-02	A429TX3_A	P1-52
-15V	P1-03	A429TX3_B	P1-53
ON/OFF	P1-04	A429RX1_A	P1-54
ON/OFF_RET	P1-05	A429RX1_B	P1-55
RAD_ALT_IN_HI	P1-06	ALT_A1	P1-56
RAD_ALT_IN_LO	P1-07	ALT_A2	P1-57
DPWR+15_OUT	P1-08	ALT_A4	P1-58
DPWR-15_OUT	P1-09	ALT_B1	P1-59
DSPLY_GND_OUT	P1-10	ALT_B2	P1-60
HSYNC_OUT+	P1-11	ALT_B4	P1-61
HSYNC_OUT-	P1-12	A429RX2_A	P1-62
VSYNC_OUT+	P1-13	A429RX2_B	P1-63
RAD_ALT_FLG	P1-14	A429RX3_A	P1-64
SMS	P1-15	A429RX3_B	P1-65
VIDEO_OUT+	P1-16	LP1OUT	P1-66
VIDEO_OUT-	P1-17	ALT_C1	P1-67
$\overline{\text{SFTKEY1\_IN}}$	P1-18	ALT_C2	P1-68
$\overline{\text{SFTKEY2\_IN}}$	P1-19	ALT_C4	P1-69
$\overline{\text{SFTKEY3\_IN}}$	P1-20	ALT_D2	P1-70
$\overline{\text{SFTKEY4\_IN}}$	P1-21	ALT_D4	P1-71
VSYNC_OUT-	P1-22	ALT_COMN	P1-72
SMS_RET	P1-23	A429RX4_A	P1-73
SQUAT	P1-24	A429RX4_B	P1-74
DPWR+15_IN	P1-25	A429RX5_A	P1-75
DPWR-15_IN	P1-26	A429RX5_B	P1-76
DSPLY_GND_IN	P1-27	RS422_TXA	P1-77
HSYNC_IN+	P1-28	RS422_TXB	P1-78
HSYNC_IN-	P1-29	RS422_RXA	P1-79
VSYNC_IN+	P1-30	RS422_RXB	P1-80
OPER_MODE	P1-31	A429RX8_A	P1-81
DI02	P1-32	A429RX8_B	P1-82
GEAR	P1-33	A429RX7_A	P1-83
GPWS	P1-34	A429RX7_B	P1-84
VIDEO_IN+	P1-35	LP2OUT	P1-85
VIDEO_IN-	P1-36	RS232_TX2	P1-86
$\overline{\text{SFTKEY1\_OUT}}$	P1-37	RS232_RX2	P1-87
$\overline{\text{SFTKEY2\_OUT}}$	P1-38	RS232_GND2	P1-88
$\overline{\text{SFTKEY3\_OUT}}$	P1-39	AUDIO_H	P1-89
$\overline{\text{SFTKEY4\_OUT}}$	P1-40	AUDIO_L	P1-90
VSYNC_IN-	P1-41	AUDIO_C	P1-91
A429TX1_A	P1-42	PLUG_GND	P1-92
A429TX1_B	P1-43	SUPBUS	P1-93
A429TX2_A	P1-44	ASU_SEL	P1-94
A429TX2_B	P1-45	ASU_MODE	P1-95
HEADING_X	P1-46	ASU_SEL_ACK	P1-96
HEADING_Y	P1-47	ASU_MOD_ACK	P1-97
HEADING_Z	P1-48	ASU_GND	P1-98
HEADING_H	P1-49	SDA	P1-99
HEADING_C	P1-50	SCL	P1-100

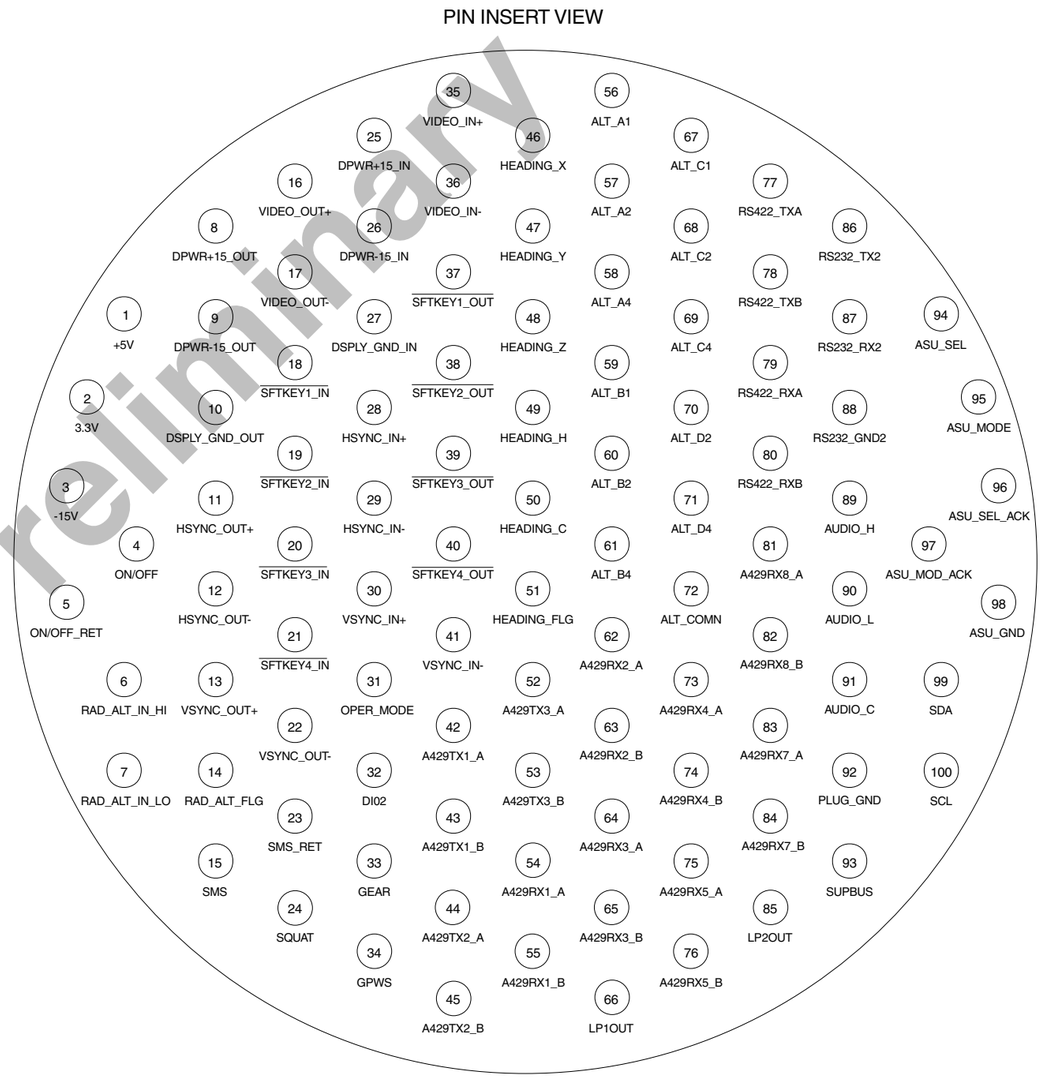


Figure A-1. P1 Connector Pin Identifiers

A.3 ARINC-429 LABELS

The various interface equipment and their ARINC-429 labels (accepted and transmitted) are listed in tables A-3 and A-4. Any input labels not listed in table A-3 are rejected and not used by the SKY899.

Table A-3. ARINC-429 Input Labels (Rx)

Equipment	Data	Label
Air Data Computer	Altitude	203*
	Baro Corrected Altitude #1	204
	Altitude Rate	212
	Altitude Rate	232
	General Aviation Equipment ID	371
	Equipment ID	377
GPS (GAMA)	Greenwich Mean Time (BCD)	125
	Greenwich Mean Time (BNR)	150
	Date (BCD)	260
	GPS Discrete Word 1 (DSC)	261*
	Present Position Latitude (BNR)	310*
	Present Position Longitude (BNR)	311*
	Ground Speed (BNR)	312*
	Track Angle (BNR)	313*
	Specific Equipment ID (DSC)	371
	Equipment Hex ID Code (DSC)	377
GPS (GNSS)	GPS Altitude	076
	HDOP	101
	VDOP	102
	GPS Track Angle	103*
	GPS Latitude	110*
	GPS Longitude	111*
	GPS Ground Speed	112*
	GPS Latitude Fine	120
	GPS Longitude Fine	121
	UTC	125
	Horizontal Integrity Limit (HIL)	130*
	UTC	150
	Vertical Velocity	165
	Date	260
	Equipment ID	377
Attitude & Heading Reference System Either Label 314 or 320 is required for input to be used.	Magnetic Heading	014
	True Heading	314*
	Magnetic Heading	320*
	General Aviation Equipment ID	371
	Equipment ID	377
Radio Altimeter	Radio Height	164*
	Equipment ID	377

* Required for ARINC-429 Input to be used.

Table A-4. ARINC-429 Output Labels (Tx)

Equipment	Data	Label
External Display	DITS Control	013
ARINC-735 TCAS I Formatted Traffic Data	Altitude Select Limits	015
	DITS Control	016
	Intruder Range	130
	Intruder Altitude	131
	Intruder Bearing	132
	Own A/C Altitude.	203
	Vertical RA	270
	Transponder Control	274
	Own A/C Heading.	320
	Fault Summary	350
	(RTS) Request To Send	357
	(ETX) End of Transmission	357
	GA Equipment Ident	371
	Equipment Identifier	377

APPENDIX B
ENVIRONMENTAL QUALIFICATION FORM

This appendix includes the environmental qualification forms required for the SKY899 system. Forms included are for the TRC899, NY156 & NY164 antennas, and WX-1000/SKY497 display.

B.1 TRC899 ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: SKYWATCH® HP
MODEL: TRC899 TSO NO.: TSO-C118 and TSO-C147
PART NO.: 805-11900-001 APPLICABLE SPEC. NO.: RTCA/DO-197A

MANUFACTURER: BFGoodrich Avionics Systems, Inc.
ADDRESS: 5353 52nd Street SE, Grand Rapids, MI 49512
(616) 949-6600

Revision & Change Number of DO-160: DO-160D

CONDITION	SECTION/ PARAGRAPH	TEST DESCRIPTION
Temperature and Altitude	4.0	Tested to Category F2
Low Temperature	4.5.1	-55° Celsius
Ground Survival High Temp.	4.5.2	+85° Celsius
Operating High Temp.	4.5.3	+70° Celsius
Loss of Cooling	4.5.4	Category X-No test performed
Altitude	4.6.1	55,000 ft. MSL
Decompression	4.6.2	Not Applicable
Overpressure	4.6.3	Not Applicable
Temperature Variation	5.0	Tested to Category B
Humidity	6.0	Tested to Category A
Operational Shock and Crash Safety	7.0	Tested to Category B
Vibration	8.0	Category S, aircraft zone 2 using vibration test curves B and M for fixed wings; Category U, aircraft zone 1 using test curves F and F1 for helicopter without shock mounts
Explosion Proofness	9.0	Category X - No test performed
Waterproofness	10.0	Category X - No test performed
Fluids Susceptibility	11.0	Category X - No test performed
Sand and Dust	12.0	Category X - No test performed
Fungus Resistance	13.0	Category X - No test performed
Salt Spray	14.0	Category X - No test performed

TRC899 Environmental Qualification Form (Continued)

CONDITION	SECTION/ PARAGRAPH	TEST DESCRIPTION
Magnetic Effect	15.0	Tested to Class Z
Power Input	16.0	Tested to Category B
Voltage Spike	17.0	Tested to Category A
Audio Frequency Susceptibility	18.0	Tested to Category B
Induced Signal Susceptibility	19.0	Tested to Category A
Radio Frequency Susceptibility	20.0	Tested to Category U for conducted and category U for radiated. Category X for pulse test - No test performed
Radio Frequency Emission	21.0	Tested to Category L
Lightning Induced Transient Susceptibility	22.0	Category XXXX- No test performed
Lightning Direct Effects	23.0	Category X - No test performed
Icing	24.0	Category X - No test performed
Electrostatic Discharge	25.0	Tested to Category A

B.2 NY156 & NY164 ANTENNA ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: SKYWATCH®
MODEL: NY156 & NY164 TSO NO.: TSO-C118
PART NO.: 805-10003-001 & 805-10890-001
APPLICABLE SPEC. NO.: RTCA/DO-160C

MANUFACTURER: Sensor Systems, Inc.
ADDRESS: 8929 Fullbright Ave., Chatsworth, CA 91311 USA
(818) 341-5366

Revision & Change Number of DO-160: DO-160C

CONDITIONS	SECTION	TEST DESCRIPTION
Temperature and Altitude	4.0	Equipment tested to Categories F2.
Low Temperature	4.5.1	-55 Degrees Celsius
High Temperature	4.5.2 & 4.5.3	+70 Degrees Celsius
In-Flight Loss of Cooling	4.5.4	- Not Applicable -
Altitude	4.6.1	55,000 Feet
Decompression	4.6.2	- Not Applicable -
Overpressure	4.6.3	- Not Applicable -
Temperature Variation	5.0	Equipment tested to Category A.
Humidity	6.0	Equipment tested to Category C.

NY156 & NY164 Environmental Qualification Form (Continued)

CONDITIONS	SECTION	TEST DESCRIPTION
Operational Shock and Crash Safety	7.0	Operation and Crash
Vibration	8.0	Equipment tested to Category C, L, and M.
Explosion	9.0	Category X - No test performed.
Waterproofness	10.0	Equipment tested to Category S.
Fluids Susceptibility	11.0	Equipment tested to Category F.
Sand and Dust	12.0	Equipment tested to Category D.
Fungus	13.0	Equipment tested to Category F.
Salt Spray	14.0	Equipment tested to Category S.
Magnetic Effect	15.0	Category X - No test performed.
Power Input	16.0	Category X - No test performed.
Voltage Spike	17.0	Category X - No test performed.
Audio Frequency Susceptibility	18.0	Category X - No test performed.
Induced Signal Susceptibility	19.0	Category X - No test performed.
Radio Frequency Susceptibility	20.0	Category X - No test performed.
Radio Frequency Emission	21.0	Category X - No test performed.
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Category L.
Lightning Direct Effects	23.0	Equipment tested to Category 2A.
Icing	24.0	Category X - No test performed.
Other Tests		No test required

B.3 WX-1000/SKY497 DISPLAY ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: *Stormscope*®
MODEL: WX-1000 TSO NO.: TSO-C113
PART NO.: 78-8060-5900-8 APPLICABLE SPEC. NO.: RTCA/DO-160C

MANUFACTURER: BFGoodrich Avionics Systems, Inc.
ADDRESS: 5353 52nd Street SE, Grand Rapids, MI 49512
(616) 949-6600

Revision & Change Number of DO-160: DO-160C

CONDITION	SECTION/ PARAGRAPH	TEST DESCRIPTION
Temperature and Altitude	4.0	Tested to Category F1-
Operating Low Temperature	4.5.1	-20° Celsius
Operating High Temperature	4.5.3	+55° Celsius
Short-Time Operating High Temp.	4.5.2	+70° Celsius
Loss of Cooling	4.5.4	-Not Applicable-
Ground Survival Low Temp.	4.5.1	-55° Celsius
Ground Survival High Temp.	4.5.2	+85° Celsius
Altitude	4.6.1	55,000 Feet MSL
Temperature Variation	5.0	Tested to Category C
Humidity	6.0	Tested to Category A
Operational Shock and Crash Safety	7.0	
Operational Shock	7.2	6 g's Peak
Crash Safety	7.3	15 g's all axes
Vibration	8.0	Tested to Categories [NBM] Instrument Panel Mount Without Vibration Isolators
Explosion Proofness	9.0	Category X - No test required
Waterproofness	10.0	Category X - No test required
Fluids Susceptibility	11.0	Category X - No test required
Sand and Dust	12.0	Category X - No test required
Fungus Resistance	13.0	Category X - No test required
Salt Spray	14.0	Category X - No test required
Magnetic Effect	15.0	Tested to Class Z
Power Input	16.0	Category X - No test required
Voltage Spike	17.0	Category X - No test required
Audio Frequency Susceptibility	18.0	Category X - No test required
Induced Signal Susceptibility	19.0	Tested to Category Z
Radio Frequency Susceptibility	20.0	Tested to Category U
Radio Frequency Emission	21.0	Tested to Category A
Lightning Induced Transient Susceptibility	22.0	Category X - No test required
Lightning Direct Effects	23.0	Category X - No test required
Icing	24.0	Category X - No test required
Other Tests		X-Ray Radiation
Other Tests		U.V. Radiation
Other Tests		Thermal Shock

APPENDIX C
INSTALLATION CHECKOUT
USING THE TCAS-201 RAMP TEST SET

C.1 INTRODUCTION

This section contains instructions for using the TCAS-201 Ramp Test Set (with TCAS I firmware) to do post-installation checkout of the BFG Avionics Systems SKYWATCH® HP SKY899. This procedure provides test setup data for the TCAS-201 ramp test set, refer to manufacturers instructions for detailed setup, operation and maintenance information.

NOTES

1. This procedure assumes familiarity with the set up and operation of the TCAS-201 ramp test set.
2. All test equipment used in completing these tests shall be calibrated in accordance with the manufacturer's recommendations.
3. When the SKY899 is interfaced to an alternate display, reference Appendix F while performing this checkout procedure.

This procedure will validate the installation and return to service of the BFGoodrich Avionics Systems SKY899.

C.2 CONTROLS

All operating controls are located on the front of the WX-1000/SKY497 display. Figure C-1 shows the locations of the controls. Complete operating instructions for the SKY899 are provided in the SKY899 Pilot's Guide supplied with each system.

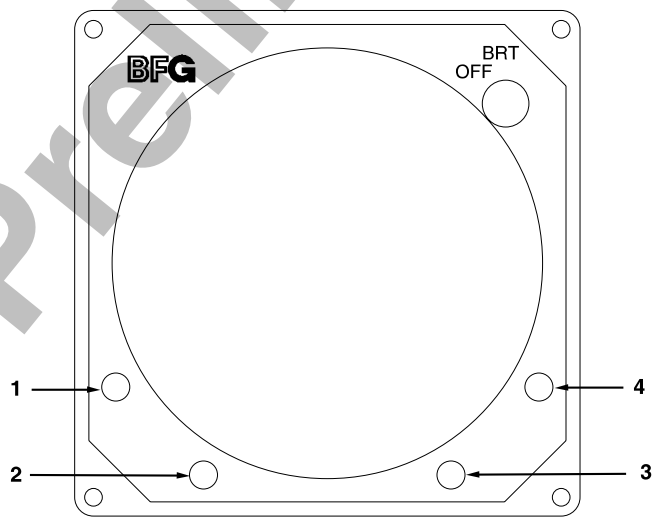


Figure C-1. Controls

OFF/BRT Switch	Power is applied by rotating the knob clockwise past the detent. Continued clockwise rotation increases display brightness.
1, 2, 3, & 4 Pushbuttons	Also referred to as soft-keys (1), (2), (3), and (4). In every operating mode a label identifying the button function will be displayed next to the button.

C.3 CHECKOUT PROCEDURE

If the indications given in the following steps, except for the ramp test set, are not obtained, refer to the troubleshooting procedures in Chapter 4. If indications given for the ramp test set are not obtained, refer to the manual supplied with that equipment.

1. Enter and store the setup information identified in table C-1 into the TCAS-201 Ramp Test Set.

Table C-1. IFR Systems TCAS-201 Ramp Test Set Setup Data

SCREEN		STORAGE NUMBER 1
SETUP #1	INTRUDER TYPE:	ATCRBS
	UUT DIST: HORIZ =	Distance (ft.) from aircraft
	UUT DIST; VERT =	Vertical height (ft.) difference between test antenna and SKY899 antenna
	ALT REPORTING:	ON
	STORE	0
	RECALL	0
	GAIN_1030	9.4 dB
	LOSS	1.3 dB
SETUP #2	RANGE MAX:	35 NM (was 20 NM for Sky497)
	RANGE MIN:	0 NM
	ALT MAX:	60,000 ft
	ALT MIN:	0 ft
SCENARIO TEST	RANGE:	5.0 NM
	RANGE RATE:	+200 kt
	ALT:	51,000 ft
	ALT: RATE:	0 FPM
REPLY TEST	RANGE:	5.0 NM
	ALTITUDE	50,500 ft
	%REPLY:	100 %

2. Make sure the aircraft's transponder is in the STBY mode and the DME is turned OFF. At the aircraft's instruments, verify all compass/HSI flags are valid.

NOTE

After power up, it may take a couple of minutes for the altitude encoder to return a valid altitude to the transponder and SKY899.

3. Turn SKY899 ON. The display will show a start-up screen similar to one shown in figure C-2. After start-up screen appears, rotate the OFF/BRT switch. Verify that clockwise rotation increases display brightness.

Figure C-2. Start-up Screen

After approximately thirty seconds the display will show the STANDBY screen (see figure C-3).

NOTE

If the TRC has not been calibrated to the directional antenna the display may show a "SKY899 FAILED" message. Calibration will be done during system setup.

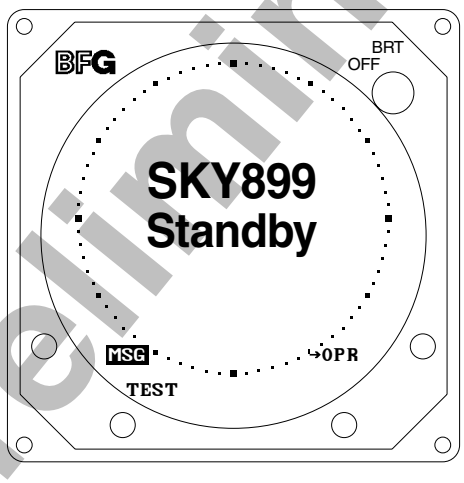


Figure C-3. Standby Screen

4. Perform System Setup in paragraph 3.3.1. (If System Setup has already been done, proceed to next step.)
5. Turn SKY899 OFF and then enter the Service Menu (see paragraph 4.4) by holding the left two buttons (soft-keys 1 and 2) depressed as the system is turned ON.
6. From the Service Menu, calibrate the TRC to the directional antenna (see paragraph 4.4.3). If calibration was just done during System Setup (see paragraph 3.3.1) proceed to next step.
7. Return to the Service Menu and select Information.
8. From the Information menu, select Data Monitor. The Data Monitors menu will appear.
9. Select each of the data monitors and verify the sensor information is correct (see paragraph 4.4.2.3):
    a. Change the status of the landing gear, squat switch, altitude, and heading sensors. Verify data monitors show the correct input changes (i.e., sensing of these signals).

b. If the information is not correct, the sensor has failed to communicate with the TRC. Check operation of the sensor and connections between the TRC and sensor.

c. Select exit until you return to the Service Menu.

10. Do SKY899 self test (paragraph 3.4).
11. From the Service Menu, select Ground Test (see paragraph 4.4.4).
12. From Ground Test menu, select Perform Ground Test.
13. Verify operation of range function. Soft-key (3) is labeled to indicate the current range. Press soft-key (3) to toggle the display range between 2, 6 and 15 nm.
14. Select the 6 nautical mile range.
15. Verify that the system toggles through the altitude display modes. Soft-key (2) is labeled to indicate the current mode. Press Soft-key (2) to select normal (NRM), below (BLW), and above (ABV).
16. Select the NRM (normal) mode.
17. Position the aircraft with the nose aligned on any 90 degree heading. Avoid areas within 250 ft of obstructions (e.g., hangers, large aircraft, control towers, etc.) where there is a potential for multipath problems. Locate and mark test points, every 30 degrees (i.e., at 000, 030, 060, 090, 120, 150, 180, 210, 240, 270, 300, and 330 degrees with respect to the SKY899 directional antenna). Mark these points at the same distance, approximately 100 ft, from the aircraft.
18. Do the following static tests:

    a. Connect the TCAS-201 Flat Antenna (facing towards the test aircraft) to the antenna connector.

    b. At the TCAS-201 test set, press the REPLY TEST key.

    c. Initiate the REPLY TEST by pressing the ANTENNA push button switch or the RUN/STOP key.

    NOTE

    The TCAS-201 display will indicate “NO WHISPER-SHOUT SEQUENCE”.

    d. Verify that the SKY899 display shows an other traffic symbol (open diamond) at the 12 O'clock position (±30 degrees), approximately 5.0 nm, in level flight, and at an altitude of 500 ft above own aircraft (i.e., "+05").

    NOTES

    1. If the display reflects a gross error in target bearing, check the directional antenna cables at TRC connectors J9 (sum port) and J11 (difference port). They may be reversed. A further indication of this condition would be a target that moved in a counter-clockwise direction when the test set is moved in a clockwise direction.
    2. Multiple targets or a faulty bearing may result from multipath distortion (see step 2).
    3. During these tests, the SKY899 may detect and display other active targets.

    e. Repeat a, b, c, and d from each of the test points (see step 2).

19. Do the following dynamic test.

    a. Position the ramp test set on the test point directly in front of the test aircraft (i.e., approximately 100 ft in front of the aircraft, see step 2).

    b. Connect the TCAS-201 Flat Antenna (facing towards the test aircraft) to the antenna connector.

    c. At the TCAS-201 test set, press the SCEN key.

    d. Initiate the SCENARIO TEST by pressing the ANTENNA push button switch or the RUN/STOP key.

e. Verify that the display shows an "other traffic" symbol (open diamond) at the 12 o'clock position (±30 degrees) approximately 5.0 nm and in level flight. The traffic symbol should be at an altitude of 500 ft above own aircraft (i.e., "+05") and moving towards your aircraft.

f. When the target approaches closer than approximately 1 nm from own aircraft, verify that the symbol changes from an other traffic symbol (open diamond) to a traffic advisory (solid circle).

NOTE

The voice message, “TRAFFIC, TRAFFIC,” will be enunciated over the cockpit audio system.

g. The target, when it reaches 0.0 nm, will reverse direction and move outbound on the same heading.

NOTE

The target may momentarily drop from the display and then reappear as an other traffic symbol (open diamond).

20. This completes the post installation checkout procedure.

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APPENDIX D
INSTALLATION CHECKOUT
USING THE TIC T-49C FLIGHTLINE TESTER

D.1 INTRODUCTION

This section contains instructions for using the TIC T-49C Flightline Tester to do post-installation checkout of the BFG Avionics Systems SKYWATCH® HP SKY899. Detailed setup, operation and maintenance information for the T-49C Flightline Tester is provided in the T-49C Operating and Maintenance Instruction Manual.

NOTES

1. This procedure assumes familiarity with the set up and operation of the T-49C Flightline Tester.
2. All test equipment used in completing these tests shall be calibrated in accordance with the manufacturer's recommendations.
3. When the SKY899 is interfaced to an alternate display, reference Appendix F while performing this checkout procedure.

This procedure will validate the installation and return to service of the BFGoodrich Avionics Systems SKY899.

D.2 CONTROLS

All operating controls are located on the front of the WX-1000/SKY497 display. Figure D-1 shows the locations of the controls. Complete operating instructions for the SKY899 are provided in the SKY899 Pilot's Guide supplied with each system.

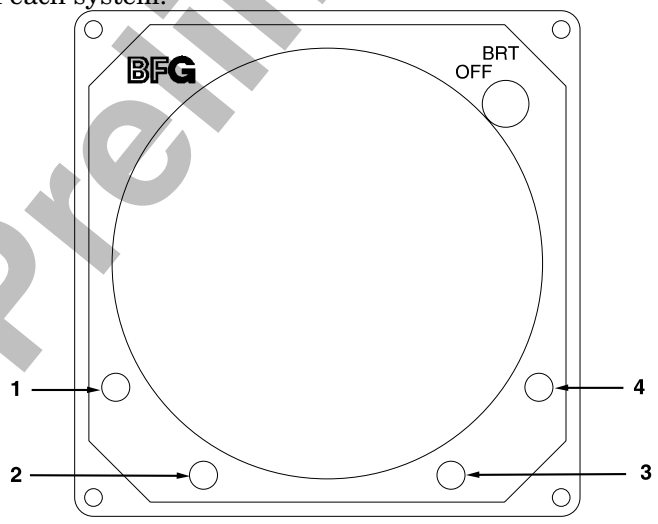

Figure D-1. Controls

OFF/BRT Switch	Power is applied by rotating the knob clockwise past the detent. Continued clockwise rotation increases display brightness.
1, 2, 3, & 4 Pushbuttons	Also referred to as soft-keys (1), (2), (3), and (4). In every operating mode a label identifying the button function will be displayed next to the button.

D.3 CHECKOUT PROCEDURE

The T-49C Flightline Tester simulates a ground based secondary surveillance radar (SSR) when the TCAS INTRUDER selector switch is in the ATCRBS/Mode-S XPDR TEST position. When the T-49C intruder type switch is set to ATCRBS, the unit responds to ATCRBS Mode C interrogations. A varying delay time, controlled from the microprocessor, delays the replies returned to the SKY899 from as far as 14 nautical miles and as close as a few hundred feet. The apparent distance from the simulated intruder to the SKY899 system under test decreases as if the intruder was converging on the aircraft under test. The test set determines the altitude of the aircraft under test by interrogating the transponder using an ATCRBS interrogation. By adding or subtracting the desired differential altitude, as selected by the front-panel scenario switch, the initial altitude of the scenario is controlled by the microprocessor. This altitude, like the distance, is varied so that the simulated intruder converges on the aircraft's position.

1. Make sure the aircraft's transponder is in the STBY mode and the DME is turned OFF. At the aircraft's instruments, verify all compass/HSI flags are valid.

NOTE

After power up, it may take a couple of minutes for the altitude encoder to return a valid altitude to the transponder and SKY899.

2. Turn SKY899 ON. The display will show a start-up screen similar to one shown in figure D-2. After start-up screen appears, rotate the OFF/BRT switch. Verify that clockwise rotation increases display brightness.

Figure D-2. Start-up Screen

After approximately thirty seconds the display will show the STANDBY screen (see figure D-3).

NOTE

If the TRC has not been calibrated to the directional antenna the display may show a “SKY899 FAILED” message. Calibration will be done during system setup.

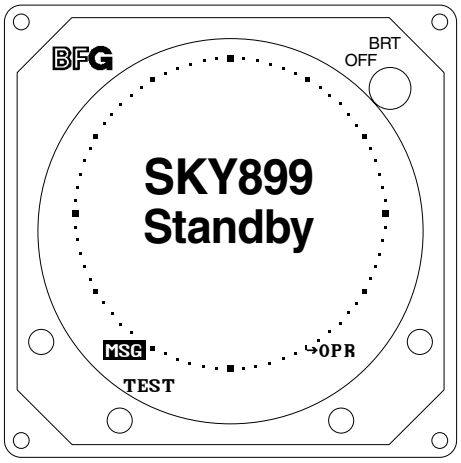

Figure D-3. Standby Screen

3. Perform System Setup in paragraph 3.3.1. (If System Setup has already been done, proceed to next step.)
4. Turn SKY899 OFF and then enter the Service Menu (see paragraph 4.4) by holding the left two buttons (soft-keys 1 and 2) depressed as the system is turned ON.
5. From the Service Menu, calibrate the TRC to the directional antenna (see paragraph 4.4.3). If calibration was just done during System Setup (see paragraph 3.3.1) proceed to next step.
6. Return to the Service Menu and select Information.
7. From the Information menu, select Data Monitor. The Data Monitors menu will appear.
8. Select each of the data monitors and verify the sensor information is correct (see paragraph 4.4.2.3):
   a. Change the status of the landing gear, squat switch, altitude, and heading sensors. Verify data monitors show the correct input changes (i.e., sensing of these signals).
   b. If the information is not correct, the sensor has failed to communicate with the TRC. Check operation of the sensor and connections between the TRC and sensor.
   c. Select exit until you return to the Service Menu.
9. Exit the Service Menu. Verify that the display shows the standby screen (figure D-3) and then press Soft-key (4), labeled OPR.
10. Verify operation of range function. Soft-key (3) is labeled to indicate the current range. Press Soft-key (3) to toggle the display range between 2, 6 and 15 nm.
11. Select the 6 nautical mile range.
12. Verify that the system toggles through the altitude display modes. Soft-key (2) is labeled to indicate the current mode. Press Soft-key (2) to select normal (NRM), below (BLW), and above (ABV).
13. Select the NRM (normal) mode.
14. If installed, turn the radio altimeter OFF.
15. Do the SKY899 self test (paragraph 3.4).
16. Position the aircraft with the nose aligned on any 90 degree heading. Avoid areas within 250 ft of obstructions (e.g., hangers, large aircraft, control towers, etc.) where there is a potential for multipath problems. Locate and mark test points at 30 degree intervals (i.e., 000, 030, 060, 090, 120, 150, 180, 210, 240, 270, 300, and 330 degrees) with respect to the SKY899 directional antenna. Mark these points at the same distance, between 100 and 150 ft, from the aircraft.

17. Change the aircraft's transponder from STBY mode to the ON position.
18. Position the T-49C Flightline Tester on one of the test points identified in previous step.

CAUTION

The Flightline Tester is not weatherproof when the lid is open. Do not setup or operate the Flightline Tester in conditions of rain, sleet, etc.

19. Setup and verify operation of the T-49C Flightline Tester with the HI/LOW power switch in the HI position and then:
    a. Set the TCAS INTRUDER selector switch of the T-49C to the ATCRBS/Mode-S XPDR TEST position and press TEST and the INTERROGATE. This will store the aircraft's barometric altitude in the T-49C.

NOTE

The T49-C will display the pressure altitude of the aircraft under test.

    b. Verify that the SKY899 display shows the standby screen (figure D-3) and then press soft-key (4), labeled OPR. Select NRM mode and 6 nm range by pressing appropriate soft-keys.
    c. Set the TCAS INTRUDER selector switch to the ATCRBS position and the SCENARIO selector switch to the 0 altitude offset position. Press INTERROGATE, and when the range on the display decreases to 5 NM, press TEST. This will freeze the scenario and represent a stationary intruder aircraft 5 NM away at the same altitude as the UUT aircraft. Verify that the SKY899 displays, in the direction (±30 degrees) of the T-49C, a symbol for other traffic (i.e., open diamond) at 5 NM. Target will be displayed in level flight at own aircraft altitude (i.e., "00" displayed above the traffic symbol).

NOTES

1) If the display reflects a gross error in target bearing, check the SKY899 directional antenna cables at TRC connectors J9 (sum port) and J11 (difference port). They may be reversed. A further indication of this condition would be a target that moved in a counter-clockwise direction when the T-49C is moved in a clockwise direction.
2) Multiple targets or a faulty bearing may result from multipath distortion (see step 1).
3) During these tests, the SKY899 may detect and display other active targets.
4) To obtain a better line of sight, it may be necessary to elevate the antenna.

    d. Move the T-49C to each test point and verify that the display shows the corresponding bearing displacement.

NOTE

It is necessary to wait a few seconds after moving to let the test target stabilize in position.

20. This completes testing with the T-49C, reattach top lid of the T-49C.
21. If installed, TURN ON the radio altimeter.
22. This completes the post installation checkout procedure.

APPENDIX E

Using the Terminal Device

(e.g., Laptop Computer)

A terminal device can be used as an aid in installing, testing and troubleshooting the SKY899. The terminal device must be connected to the RS-232 serial data TEST port (J7) located on the front of the TRC899. TRC connector J7 is a female DB9 receptacle. A standard serial cable that has RXD (pin 2), TXD (pin 3), GND (pin 5), CTS (pin 7), and RTS (pin 8) can be used. Any computer, with RS-232 terminal emulation software (e.g., Procomm®, HyperTerminal®, etc.), may be used as the terminal device. To communicate with the TRC, the RS-232 terminal device must be setup as follows, with no hardware or software handshaking (flow control) being used.

Baud Rate:	19200
Parity:	None
Data Bits:	8
Stop Bits:	1

The SKY899 includes the following commands to help with installation, testing, and troubleshooting. These commands are listed in the order they appear when the help menu is accessed and can be typed in upper case or lower case letters. Ctrl+R repeats the last command. Help screens have been created for your convenience, to access the command help screen type help or ? at the prompt. To access the help or about screen for each command, type the command followed by --help, -? or --about. Typing --help will give the command with a brief description, typing -? will give you the commands only.

NOTE

To access the service menu type menu <Enter>. Terminal device Service Menu is identical to the one described in Chapter 4, except for a prefix. Type prefix <Enter> to select a command (i.e., 1<Enter>, 2<Enter>, x<Enter>). When using service menu, system will not perform display commands (e.g., OPR, STB, MSG, or range).

Commands **Descriptions**

? or Help

The ? or help command displays a list of available commands.

? or Help: Displays the following list

//	attrib	baud	copy
del	delay	dir	dr
echo	edit	hello	help
ident	menu	ren	repeat
time	type	ver	

For Information on any particular command, enter the command followed by --help (i.e., ident --help) or -? (abbreviated help screen).

//

The // (comment) command is used for editing files and is intended for factory use only.

Commands	Descriptions
Attrib	The attrib command allows you to view or change the attributes of a file.
	Attrib [filename]: Displays file and associated attributes. (If filename is left blank all files with attributes will be displayed.)
	Attrib [[filename][+ or - [attrib]]]: Change attributes, + turns it on, - turns it off.
	Attributes are: A - Archive attribute R - Read Only attribute S - System attribute H - Hidden attribute
	Attrib -?: Abbreviated help screen. Attrib --help: Help screen with descriptions. Attrib --about: About screen information.
Baud	The baud command allows you to change the communication baud rate between the system and the terminal device.
	Baud [rate]: Changes baud rate.
	Rates are: - <None> displays current baud rate. 115200 57600 38400 19200 9600 1200
	Baud -?: Abbreviated help screen. Baud --help: Help screen with descriptions. Baud --about: About screen information.
Copy	The copy command copies files on the compact flash, where filename1 is the source file to be copied into filename2, the destination file.
	Copy [[filename1] [filename2]]: Makes duplicate copy of a file.
	Copy -?: Abbreviated help screen. Copy --help: Help screen with descriptions. Copy --about: About screen information.
Del	The del command allows you to delete a file (filename) located on the compact flash.
	Del [filename]: Deletes file from compact flash.
	Del -?: Abbreviated help screen. Del --help: Help screen with descriptions. Del --about: About screen information.

Commands	Descriptions
Delay	The delay command allows you to create a delay (pause) between commands. Can be useful when creating script files, it is intended for factory use only.
	Delay [milliseconds]: Delays specified amount of time [milliseconds] before executing the next command.
	Delay -?: Abbreviated help screen. Delay --help: Help screen with descriptions. Delay --about: About screen information.
Dir	The dir command will display all of the files located on the compact flash. If a compact flash is not present no information will appear.
	Dir: Lists all files located in a directory, if name is left blank it will show all directories and files located on the compact flash.
	Dir -?: Abbreviated help screen. Dir --help: Help screen with descriptions. Dir --about: About screen information.
DR	The dr command allows flight data to be recorded to a compact flash and is intended for factory use only.
	DR [on/off]: Records flight data. DR on opens new file and starts recording data. DR off stops recording data. If DR is on and DR on command is executed the old file is closed and a new file is opened and starts recording data.
	Attrib -?: Abbreviated help screen. Attrib --help: Help screen with descriptions. Attrib --about: About screen information.
Echo	The echo command allows you verify communication between system and terminal device. Sent text will be displayed on the laptop if proper communications has occurred.
	Echo [{text}]: Sends text through unit back to terminal device.
	Echo -?: Abbreviated help screen. Echo --help: Help screen with descriptions. Echo --about: About screen information.
Edit	The edit command allows you to edit a text file on the compact flash. Intended for factory use only.
	Edit [filename]: Opens file to be edited.
	Edit -?: Abbreviated help screen. Edit --help: Help screen with descriptions. Edit --about: About screen information.

Commands	Descriptions
Hello	The hello command allows you to see the start-up screen on the laptop (i.e., company name, software version, etc.).
	Hello: Displays start up screen.
	Hello -?: Abbreviated help screen. Hello --help: Help screen with descriptions. Hello --about: About screen information.
Help	The help command displays a list of available commands.
	Help: Displays all available commands.
	Help [{cmdname}]: Help screen with descriptions for that command. Help [all]: Displays all available commands. Help -?: Abbreviated help screen. Help --help: Help screen with descriptions. Help --about: About screen information.
Ident	The ident command displays the vcs header information of all files. Intended for factory use only.
	Ident: Shows the vcs header information of all the files.
	Ident -?: Abbreviated help screen. Ident --help: Help screen with descriptions. Ident --about: About screen information.
Menu	The menu command allows the system to enter the service menu. There are no help screens are available, type the prefix character (1, 2, x, etc.) to perform that operation.
	Example: Service Menu 1 Setup 2 Information 3 Calibration 4 Ground Test x Exit
Ren	The ren command allows you to rename a file located on the compact flash.
	Ren [{oldfilename} {newfilename}]: Changes file name.
	Ren -?: Abbreviated help screen. Ren --help: Help screen with descriptions. Ren --about: About screen information.

Commands	Descriptions
Repeat	The repeat command allows you to repeat a command a specific number of times with a specified amount of time delay between the commands execution.

Repeat [{number} {delay} {command}]: Repeats command.

{number} - number of times to be repeated, zero will cause command to repeat until a key is pressed.
{delay} - number of milliseconds delay between commands.
{command}- command to be repeated.

Repeat -?: Abbreviated help screen.
Repeat --help: Help screen with descriptions.
Repeat --about: About screen information.

Time

The SKY899 does not have a real-time clock. The time command allows you to see the time received via the GPS nav information, if available. If not available, the time displayed will be the software creation date.

Time:
The year is :2000
The month is :8
The hour is :13
The minute is :51
The second is :38
The millisecond is :3

Time -?: Abbreviated help screen.
Time --help: Help screen with descriptions.
Time --about: About screen information.

Type

The type command allows you to see the contents of a file.

Type [{filename}]: Displays the contents of a file.

Type -?: Abbreviated help screen.
Type --help: Help screen with descriptions.
Type --about: About screen information.

Ver

The ver command allows you to see the system software version. It includes the following information: MQX Copyright, MQX Library Creation Date, MQX Version, Build Copyright, Build Version, Build MakeDate, Build MakeTime, CPU Type, and CPU Number.

Ver: Displays system software version.

Ver -?: Abbreviated help screen.
Ver --help: Help screen with descriptions.
Ver --about: About screen information.

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APPENDIX F
Installation Checkout Using an Alternate Display

F.1 INTRODUCTION

This section contains installation checkout procedures for the BFGoodrich Avionics Systems SKYWATCH® HP SKY899 that is interfaced to an alternate display (e.g., EFIS, IVSI, BFGoodrich Avionics Systems RGC250, MFD).

NOTES

1. This section provides checkout information for the SKY899 interfaced to an Alternate Display.
2. When interfacing to BFG Avionics Systems RGC250, software version for RGC250 must be 1.5 or higher.
3. This procedure assumes familiarity with the set up and operation of the TT391 Flightline Tester and RS-232 terminal device (see Appendix E). If using another approved tester refer to the appropriate appendices for test procedure.
4. All test equipment used in completing these tests shall be calibrated in accordance with the manufacturer's recommendations.

This procedure will validate the installation and return to service of the BFGoodrich Avionics Systems SKY899.

F.2 CONTROLS

Operating instructions for each alternate display are provided with the display manufacturer's documentation.

NOTE

When using an alternate display all SKY899 functions are controlled through the alternate display. Each alternate display will show information consistent with the capabilities of that particular display. Therefore, the text displayed may be different from what is called out in this procedure. Reference the alternate display documentation for appropriate screen text.

F.3 CHECKOUT PROCEDURE

The TT391 Flightline Tester simulates both a ground based secondary surveillance radar (SSR) and an airborne transponder. With the SKY899 set to GROUND TEST (i.e., the barometric altimeter is simulated to 50,000 ft, heading simulated to 0 degrees, and the radar altimeter simulated to 2,500 ft) the TT391 will simulate two targets; a Traffic Advisory (i.e., a solid circle) at ¼ nm and Other Traffic (i.e., open diamond) at 4.5 nm. Both targets will be displayed in level flight at own aircraft altitude (i.e., "00" displayed above the traffic symbol).

If the indications given in the following procedure, except for the Flightline Tester, are not obtained, refer to the troubleshooting procedures in Chapter 4. If indications given for the Flightline Tester are not obtained, refer to the maintenance section of the TT391 Instruction Manual.

1. Connect the RS-232 terminal device to J7 TEST port on the TRC899. Turn ON and setup the terminal device. (See Appendix E for terminal device commands, setup, and operating instructions.)

2. Make sure the aircraft's transponder is in the STBY mode and the DME is turned OFF. At the aircraft's instruments, verify all compass/HSI flags are valid.

NOTE

After power up, it may take a couple of minutes for the altitude encoder to return a valid altitude to the transponder and SKY899.

3. Turn SKY899 ON. Start up screen similar to one shown in figure F-1 will be displayed on the terminal device. After approximately thirty seconds the alternate display will show the standby screen.

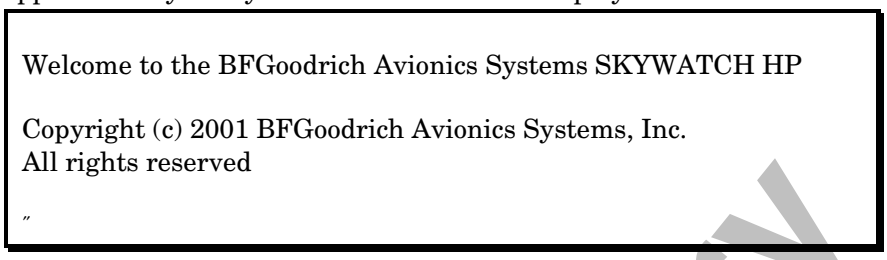

Figure F-1. SKYWATCH Startup Screen on Terminal Device

NOTE

If the TRC has not been calibrated to the directional antenna, the display may show a FAIL message. Calibration will be done during system setup.

4. At the terminal device, enter the Service Menu by typing Menu <Enter>. The service menu displayed on the terminal device is identical to the one seen in Chapter 4, except each command has a prefix. To select a menu item type the prefix <Enter> (i.e., 1 <Enter>, 2 <Enter>, x <Enter>, etc.).

NOTE

While using service menu, system will not perform display commands (e.g., OPR, STB, MSG, or range).

5. Perform the System Setup in paragraph 3.3.1 (start at step 2 of par. 3.3.1).
6. Turn ON all avionics equipment interfaced to the SKY899.
7. From the Service Menu (see paragraph 4.4), select Information.
8. From the Information menu, select Data Monitor. The Data Monitors menu will appear.
9. Select each of the data monitors and verify the sensor information is correct (see paragraph 4.4.2.3):
   a. Change the status of the landing gear, squat switch, altitude, and heading sensors. Verify data monitors show the correct input changes (i.e., sensing of these signals).
   b. If the information is not correct, the sensor has failed to communicate with the TRC. Check operation of the sensor and connections between the TRC and sensor.
   c. Select exit until you return to the Service Menu.
10. At the alternate display, perform the SKYWATCH HP self-test (see paragraph F.4).
11. At the terminal device, enter the Service Menu by typing Menu <Enter>.
12. From the Service Menu, select Ground Test (4 <Enter>).
13. From the Ground Test menu, select Perform Ground Test (1 <Enter>).
14. At the alternate display, verify ground test screen is being displayed. Change the display ranges and verify display range patterns are correct.
15. Select the 6 nautical mile range.

16. Change the altitude display modes from normal (NRM), below (BLW), above (ABV), and unrestricted (UNR). Verify that the system toggles through the altitude display modes correctly (some alternate displays do not support unrestricted display mode). If external annunciators are connected verify correct operation (see figure F-2).

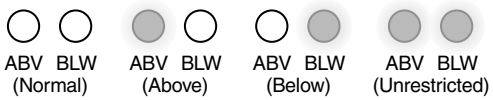

Figure F-2. External Annunciator Operation.

17. If oper_mode annunciator (optional) is connected, verify annunciator works when system is turned ON.
18. Select the normal (NRM) mode.
19. Position the aircraft with the nose aligned on any 90 degree heading. Avoid areas within 250 ft of obstructions (e.g., hangers, large aircraft, control towers, etc.) where there is a potential for multipath problems. Locate and mark test points at 30 degree intervals (i.e., 000, 030, 060, 090, 120, 150, 180, 210, 240, 270, 300, and 330 degrees) with respect to the directional antenna. Mark these points at the same distance, between 100 and 150 ft, from the aircraft.
20. Position the TT391 Flightline Tester on one of the test points identified above.

CAUTION

The Flightline Tester is not weatherproof when the lid is open. Do not setup or operate the Flightline Tester in conditions of rain, sleet, etc.

21. Setup and verify operation of the TT391 Flightline Tester:
    a. Open the chassis lid and remove the lid from the chassis by sliding the lid off of the hinge pins (sliding it to the right). The lid "stay" must be removed from the lid before mounting. The stay will pop off of the lid. (The stay is the hinged part that props the lid open on the chassis).

NOTE

The Patch Antenna may be used without a tripod. The Patch Antenna can be held, or secured, and pointed towards the SKYWATCH HP aircraft under test WITH THE MOUNTING STUD POINT TOWARD THE GROUND. This orientation is critical.

    b. Mount the chassis lid, with the Patch Antenna facing the aircraft, onto a tripod (not included). The tripod must be capable of holding the antenna (approximately 2.5 lb.) and must provide a standard base mounting stud threaded 1/4"-20. A typical tripod mount is shown in figure F-3.
    c. If the internal batteries are being utilized, proceed to sub-step f. If the Flightline Tester AC Converter Power Supply is to be utilized, proceed to sub-step d.
    d. Connect the AC Converter Power Supply cable connector to the chassis external connector.
    e. Connect the AC Converter Power Supply input power cable connector to one of the following AC sources:
        - 115 V ac, 60 Hz
        - 115 V ac, 400 Hz
    f. Set the Flightline Tester POWER switch to the ON position.
    g. Verify that the LOW indicator is not steady on (it may flash). If the LOW indicator remains on (i.e., lit), perform one of the following three options:
        - Use the AC Converter Power Supply to power the unit.
        - Recharge the internal batteries.
        - Replace the internal batteries.

h. Set the SELF-TEST switch to the 1030 position and verify that the 1030 indicator blinks on for 1/2 second every 5 seconds.

i. Set the SELF-TEST switch to the 1090 position and verify that the 1090 indicator blinks on for 1/2 second every 5 seconds.

j. Set SELF-TEST switch to center position (off). Set the POWER switch to the OFF position.

NOTE

Care should be taken to ensure that the Patch Antenna is connected to TT391 connector J1 and NOT J2. IF THE PATCH ANTENNA IS CONNECTED TO J2 THE TT391 WILL NOT FUNCTION CORRECTLY.

k. Connect the Flightline Tester coax cable to J3 on the Patch Antenna and to connector J1 in the chassis. (J2 should remain capped by the dust cover).

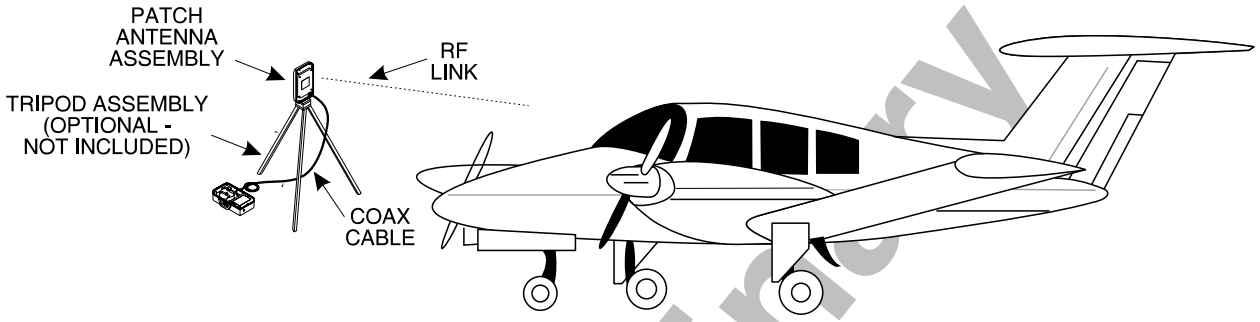

Figure F-3. Typical Patch Antenna Tripod Mount

22. From each test point (see step 13):

a. Position the TT391 Patch Antenna facing the SKYWATCH HP aircraft under test.

b. Set the TT391 POWER switch to the ON position.

c. Verify that the display shows, in the direction (± 30 degrees) of the TT391, two targets; a Traffic Advisory (i.e., a solid circle) at ¼ nm and Other Traffic (i.e., open diamond) at 4.5 nm. Both targets will be displayed in level flight at own aircraft altitude (i.e., "00" displayed above the traffic symbol).

NOTES

1. If the display reflects a gross error in target bearing, check the directional antenna cables at TRC connectors J9 (sum port) and J11 (difference port). They may be reversed. A further indication of this condition would be a target that moved in a counter-clockwise direction when the TT391 is moved in a clockwise direction.
2. Multiple targets or a faulty bearing may result from multipath distortion (see step 1).
3. During these tests, the SKY899 may detect and display other active targets.
4. To obtain a better line of sight, it may be necessary to elevate the patch antenna.

d. Set the TT391 POWER switch to the OFF. Repeat procedure from each test point. Step 16 can be done from the last test point.

NOTE

To prevent SKYWATCH HP from tracking the movement of the test-set, it is necessary to set the TT391 POWER switch to OFF after completing each bearing measurement.

23. Return the TT391 assemblies to their position in the aluminum carrying case.
24. Restart SKYWATCH HP by cycling power OFF and then ON.
25. Connect an oscilloscope to the suppression bus and verify that the SKY899 suppression pulse (100 µs ±5 µs) exceeds +15 V dc, if less than +15 V dc the suppression bus is overloaded. Check all equipment connected to the bus. Repair/replace the offending device.
26. This completes the post installation checkout procedure.

F.4 SELF TEST

1. Turn SKYWATCH HP OFF and then:
   a. Make sure the aircraft's transponder is in the STANDBY, ON, or ALT mode.

   NOTE

   After power up, it may take a couple of minutes for the altitude encoder to return a valid altitude to the transponder and SKY899.

   b. If installed, power up the radio altimeter.
   c. Make sure all compass/HSI flags are cleared from the aircraft's instruments.
2. Turn SKYWATCH HP ON.
3. After approximately thirty seconds, observe the standby screen and then perform the SKYWATCH HP self test (see alternate display operating instructions on how to perform self test).
4. If SKYWATCH HP passes the self-test, the system will return to the standby screen and the voice message, "SKYWATCH SYSTEM TEST PASSED," will be enunciated over the cockpit audio system.
5. If you do not hear the voice message or if the voice message is of insufficient volume:
   a. Check headphones/speaker and aircraft audio panel switch settings.

   NOTE

   Audio levels are adjusted via the service menu and at the aircraft audio panel. There is no internal audio adjustment.

   b. Reset the audio level via the service menu (see paragraph 4.4.1.3).
   c. Check audio connection to the TRC:
      1) 600-ohm audio systems should be connected to P1-89 (AUDIO_H).
      2) 150-ohm audio systems should be connected to P1-90 (AUDIO_L).
      3) Audio common is connected to P1-91 (AUDIO_C).

   NOTE

   Audio output from the TRC is transformer isolated.

6. If SKYWATCH HP fails the self-test:
   a. The fail screen will be displayed.
   b. The voice message, "SKYWATCH SYSTEM TEST FAILED", will be enunciated over the cockpit audio system.
   c. Refer to the fault isolation procedures and error messages in Chapter 4.

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