GDR-XXXX NAV/COM Installation Manual

REVISION HISTORY FOLLOWS ON PAGE 2.

WARNING: A printed copy of this document may not be the latest revision. It is the responsibility of the user to ensure that the latest revision is used. The latest revision of this document may be printed from the Genesys Aerosystems electronic document repository.

APPROVAL	NAME	
AUTHOR	R DuRall	PURPOSE: This document is the Installation Manual for the GDR-XXXX series Navigation and Communication radio.
CHECK	D Boston	
QUALITY	S Conn	
COGNIZANT	B DeLong	
COGNIZANT		
COGNIZANT		
RELEASE DATE:		DOCUMENT NUMBER: 64-000109
Status Draft	Typed signatures indicate approval. Handwritten, or electronic signature approval of this document is on file at Genesys Aerosystems, Anchorage, Alaska.	REV: **A**

REVISION RECORD

Rev	Notes	Date	Author
A	Original Version	See Cover Page	R DuRall

TABLE OF CONTENTS

CHAPTER 1 – INTRODUCTION 7

1. PURPOSE 7
2. SCOPE 8
3. STYLE AND DEFINITION 8
4. UNPACKING THE GDR 8
5. SPECIAL TOOLS 9
6. FUNCTIONAL DESCRIPTION 10
7. SYSTEM COMPONENTS 14
8. ELECTRICAL SPECIFICATIONS 17
   - *A. Power Inputs 17*
   - *B. System Antenna Specifications 17*
   - *C. Antenna Inputs 17*
   - *D. Microphone Inputs (DO-214, § 1.5.2) 17*
   - *E. Audio Outputs and Levels 17*
9. ENVIRONMENTAL SPECIFICATIONS 18
10. TSO APPLICABILITY 20
11. TSO DEVIATIONS 20
12. ACRONYMS AND ABBREVIATIONS 21

CHAPTER 2 – SYSTEM INSTALLATION 23

1. LIMITATIONS AND NOTES 23
   - *A. Notes and Warnings 23*
2. PRE-INSTALLATION INFORMATION 23
3. CABLING TERMINATION 24
   - *A. General 24*
   - *B. Solder Sleeve Assembly 24*
   - *C. Optional Shield Pull-Out Method 26*
   - *D. Back Shell Termination 28*
   - *E. Right Angle BNC Connector Assembly 28*
4. MOUNTING 29
   - *A. Tray Installation 29*
   - *B. Tray Assembly 30*
5. ANTENNA LOCATION 31
   - *A. COM Antenna 31*
   - *B. NAV Antenna 32*
   - *C. MB Antenna 33*
6. SIGNAL DESCRIPTION 34
   - *A. Power and Ground 34*
   - *B. RS-232 Interface 34*
   - *C. ARINC 429 Interface 34*
   - *D. MIC Audio 35*
   - *E. COM Audio and SIDETONE 35*
   - *F. PTT and TX INTERLOCK 36*
   - *G. NAV and MB AUDIO 36*
   - *H. SDI, Power, and Discrete 37*

CHAPTER 3 – SYSTEM DRAWINGS 39

1. MECHANICAL DRAWING 39
   - *A. GDR-XXXX 39*

B. GDR TRAY *40*
2. GDR-XXXX CONNECTOR DRAWINGS 41
A. P1 Connector *41*
B. P2 Connector *42*
3. WIRING DIAGRAMS 43

CHAPTER 4 – GROUND FUNCTIONAL TESTS 46

CHAPTER 5 – TROUBLESHOOTING 49

1. TOOLS 49
2. SETUP 49
3. FAULT INDICATIONS 49
4. FAILURES 49
5. COM PORT INSPECTOR 49
6. GDR-XXXX MAINTENANCE UTILITY 49

APPENDIX A – ARINC 429 SPECIFICATIONS 50

1. ARINC LABELS 030 AND 047, VHF COM 51
2. ARINC LABEL 034, VOR/ILS FREQUENCY 52
3. ARINC LABEL 035, DME FREQUENCY 53
4. ARINC LABEL 040, UHF COM 54
5. ARINC LABEL 173, LOC DEVIATION 56
6. ARINC LABEL 174, G/S DEVIATION 57
7. ARINC LABEL 222, VOR BEARING AND MARKER BEACON TONES 58
8. ARINC LABEL 242 & 244, VOR GROUND STATION ID 59
9. ARINC LABEL 263 & 264, ILS GROUND STATION ID 60
10. ARINC LABEL 350 LRU MAINTENANCE STATUS 61
11. ARINC 429 UPDATE RATE (ARINC 429-18, ATTACHMENT 2) 62

LIST OF FIGURES

Figure 1: GDR-XXXX 10
Figure 2: GDR Block Diagram 13
Figure 3: Solder Sleeve Assembly...24
Figure 4: Wire Termination..25
Figure 5: Shield Pull-Out Method..27
Figure 6: Shield Pull-Out Method (Continued)...27
Figure 7: Right Angle BNC Connector...28
Figure 8: Tray Assembly 30

LIST OF TABLES

Table 1: Installation Guide Style Conventions..8
Table 2: Special Tools Required...9
Table 3: List of Specifications and Major Components 14
Table 4: GDR-XXXX Configuration...14
Table 5: GDR Installation Kit P/N 42-033100-0001..15
Table 6: List of Possible Antennas...16
Table 7: List of VHF COM Antennas 31
Table 8: List of Extended VHF COM Antennas..32
Table 9: List of VHF & UHF COM Antennas 32
Table 10: List of NAV Antennas...32
Table 11: List of MB Antennas...33
Table 12: VHF COM 118 MHz Frequency with 25 kHz or 8.33 kHz channel bandwidth 51
Table 13: Sign Status Matrix definition and SDI bit definition..51
Table 14: NAV Frequency Selection Format for 109.3 MHz, ARINC Label 034 52
Table 15: Definition of Bits 11 to 13 for Label 034...52
Table 16: Sign Status Matrix definition 52
Table 17: ARINC SDI bit definition...52
Table 18: DME Frequency Format for 109.3 MHz, ARINC Label 035..................................53
Table 19: ARINC Label 035, Bits 11-13...53
Table 20: Sign Status Matrix definition 53
Table 21: Navigation source bit definition...53
Table 22: ARINC Label 035 SDI bit definition 53
Table 23: UHF COM Data Format Label 040...54
Table 24: Modulation Bits...54
Table 25: Bit 13 54
Table 26: SDI bit definition 54
Table 27: Sign Status Matrix definition 54
Table 28: LOC Deviation Specification, ARINC Label 173 56
Table 29: LOC Deviation Format, ARINC Label 173...56
Table 30: Status Matrix definition...56
Table 31: Sign Bit definition 56
Table 32: Glideslope Deviation Specification, ARINC Label 174......................................57
Table 33: Glideslope Deviation Format, ARINC Label 174...57
Table 34: Status Matrix definition...57
Table 35: Sign Bit definition 57
Table 36: VOR Bearing Specification, ARINC Label 222...58
Table 37: VOR Bearing Format, ARINC Label 222...58
Table 38: Status Matrix definition...58

Table 39: Sign Bit definition 58
Table 40: Marker Beacon Tone Bit definition 58
Table 41: Morse code first word format, ARINC Label 263........ 59
Table 42: Morse code second word format, ARINC Label 264........ 59
Table 43: Status Matrix definition........ 59
Table 44: Morse code first word format, ARINC Label 263........ 60
Table 45: Morse code second word format, ARINC Label 264........ 60
Table 46: Status Matrix definition........ 60
Table 47: Sign Bit definition 60
Table 48: Maintenance Status 61
Table 49: Label 350 maintenance bit definition........ 61
Table 50: Status Matrix definition........ 62

CHAPTER 1 – INTRODUCTION

1. PURPOSE

This manual provides a description of the Genesys Aerosystems (Genesys) Digital Radio (GDR) series installation in an aircraft. The GDR can be used for new or retrofit installations. The most recent version of this installation manual is always located online at www.genesys-aerosystems.com under the "DealerLink" tab.

NOTE: "The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install 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. If not within the TSO standards, the article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator."

CAUTION: These instructions are intended for use by installers familiar with standard aircraft avionics practices and methods of installation. If you do not have prior experience with or knowledge of avionics installations, do not attempt the following installation. Genesys will not be held liable for damaged items resulting from improper handling and installation.

CHAPTER 1 – INTRODUCTION

2. SCOPE

This manual includes installation and checkout procedures for the GDR.

Chapter 1: Provides an **introduction** to the GDR.
Chapter 2: Includes **system installation** instructions.
Chapter 3: Includes **unit drawings**, both mechanical and electrical.
Chapter 4: Includes **ground maintenance** procedures.
Chapter 5: Includes **ground functional test** procedures.
Chapter 6: Includes **troubleshooting** procedures.
Appendix A: Includes **ARINC 429** specifications.

3. STYLE AND DEFINITION

Stylistic elements used throughout this manual are listed in Table 1. These styles are used to emphasize text, to make the information more accessible during installation and to make the online manual more interactive.

Table 1: Installation Guide Style Conventions

Style	Description	Uses
Steps	Numbered steps that together form a set of instructions for installing a specific GDR.	The numbered steps provide guidance through the proper sequence of installation procedures.
Checklists	Installation procedures with checkboxes beside them. All the procedures in the checklist must be performed, but do not need to be performed in a specific order.	The checklist will help track the installation progress. Place a check mark on the PASS or FAIL line after completion of each procedure.
NOTE:	Capitalized underlined text followed by a colon.	The note format is used to highlight and further explain certain installation and operation details
CAUTION:	Bold, capitalized underlined text followed by a colon.	This warning format is used to flag important installation considerations. Failure to heed the information in the warnings could cause bodily harm or death.
WARNING:	Bold, capitalized underlined text followed by a colon.	This caution format is used to flag important installation considerations. Failure to heed the information in the warnings could cause damage to the aircraft or damage to the product.

4. SPECIAL CONSIDERATIONS

WARNING:

A. Changes or modifications to the equipment not expressly approved by the Genesys Aerosystem could void the user's authority to operate the equipment.

B. It is the responsibility of the operator of this equipment to obtain any necessary FCC licenses for transmitting with this equipment and transmit only on authorized channels.

5. UNPACKING THE GDR

A. System components are shipped in packaging designed to protect the components during transit. Carefully unpack and identify each component using the list in Table 3. Check the contents of the package against the packing list in the box. Visually inspect each individual component for any signs of damage.

B. Keep all shipping containers and packaging in case they are needed for returning items. Contact Genesys immediately if there are missing or damaged components. Before returning any items, please contact Genesys by one of the means below.

Phone: (800) 872-7832
Fax: (940) 325-3904
E-mail: genesys-support@genesys-aerosystems.com

C. A claim must be filed for a damaged product within 48 hours of receiving the equipment.

D. Most of the items required for installation are supplied in the original package from Genesys. Supplemental items (not included in the package) are the responsibility of the installer.

6. SPECIAL TOOLS

A. In addition to a standard aircraft mechanic's tool set, crimp tools and locators that meet MIL specification M22520 will be needed. These tools will ensure consistent, reliable crimp contact connections.

Table 2: Special Tools Required

Tool Description	Part Number
Crimp Tool	M22520/1-01
Positioner	TH25
Crimp Tool	M22520/2-01
Positioner	M2520/2-08
Insertion Tool	CIET-20HD

B. In addition, the following tools and supplies should be available:

- A digital multi-meter for testing internal terminators on cable assemblies, and for testing voltage
- Force gauge that can measure push and pull forces up to 90 pounds

7. FUNCTIONAL DESCRIPTION

A. The GDR is a remotely mounted Very High Frequency (VHF) Navigation (NAV) receiver, a VHF Communications (COM) receiver, an Ultra High Frequency (UHF) Communications receiver and Marker receiver contained in a single rack-mounted enclosure. A single transmitter is shared between the VHF and UHF COM radios. The features included in the GDR are configured during manufacturing as defined by the part number. The GDR is intended for air traffic control (ATC) communications and VOR/ILS navigation.

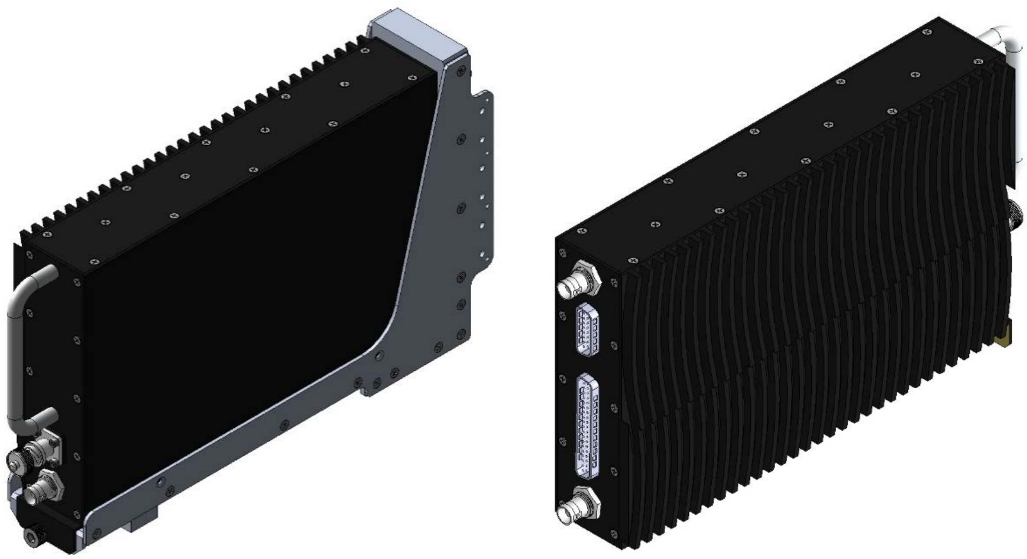


Figure 1: GDR-XXXX

B. **COM RX:** Four (4) communications receivers are included in the GDR unit; two (2) for VHF (Main and Guard) and two (2) for UHF (Main and Guard). Each band has a separate audio output for audio panel interfacing. Guard and Main audio are combined on the same output for each band. Audio volume control is available in the radio for single pilot operation when an audio panel is not available.

C. **COM TX:** The GDR shares a single transmitter for VHF and UHF frequencies. The VHF and UHF receivers have a separate microphone (MIC) inputs, Push-To-Talk (PTT), and audio output for interface with the aircraft's audio system. The transmit frequency is determined by the PTT selected and the Main receiver channel. Simultaneous VHF and UHF transmission is not allowed.

D. **COM Classes:** TX class, 3 and 5. RX class, C, D, and E.

E. **Sidetone:** A separate Sidetone audio output is available. Sidetone can be configured to be on the receiver' audio output or obtained from the independent Sidetone audio output. When Sidetone is combined with the audio, only the transmit band's audio will have Sidetone present.

F. **COM TX Power:** The transmitter is configured for either 16 Watts or 25 Watts as determined by the part number. This is identified by the number “16” or “25” respectively as the first two digits in the model number.

G. **VHF frequency range:** Depending on the model number, the VHF receiver operates in the 118 MHz to 136.991 MHz, or the extended 118 MHz to 155.975 MHz range with either 8.33 KHz or 25 KHz spacing. This is identified with the number “36” or “56” respectively as the third and fourth digits in the model number. The 8.33 kHz spacing is used in the ICAO EUR region states.

H. **UHF frequency range:** Units with UHF transceivers operate from 225 MHz to 399.975 MHz with either 12.5 KHz or 25 KHz spacing. The letter “U” at the end of the model number designates that the UHF option has been enabled. The UHF transceiver can operate in simplex or semi-duplex mode.

I. **COM guard receivers:** Guard receivers are factory configured with the standard emergency frequencies of the 121.5 MHz and/or 243 MHz. The receivers may be disabled or configured for other channels as desired.

J. **TX interlock:** A TX interlock input is available when needed for multiple transmitter installations.

K. **NAV ILS/VOR receiver:** The GDR has a combined VHF Omnidirectional Radio (VOR) and Localizer (LOC) receiver. The VOR covers 160 channels and the LOC covers 40 channels in the 108.00 to 117.95 MHz range.

L. **NAV audio:** The GDR provides a separate audio outputs for the VOR/LOC. Audio volume control is available in the radio for single pilot operation when an audio panel is not available.

M. **Glideslope receiver:** The GS channels are automatically paired by the radio to provide Instrument Landing System (ILS) guidance on Localizer channels. The GS covers 40 channels in the 330.95 MHz to 334.70 MHz range.

N. **NAV antenna:** The Glideslope and NAV receivers share a common antenna input through an internal RF diplexer. The GDR is intended to be connected to a combined VOR/LOC/GS antenna to be supplied by the installer. If two GDRs are installed, an external NAV/GS splitter, similar to a Sensor Systems Model SSPD-113-10 or equivalent, may be installed to route the VOR/LOC/GS signal to both GDR receivers. This splitter is to be supplied by the installer. Alternately two NAV antennas may be installed for redundancy. The GDR can tune an external Distance Measuring Equipment (DME) transceiver using the ARINC 429 communications bus.

O. **Marker beacon receiver:** The GDR has a MB receiver, which uses a separate BNC connector mounted on the front of the chassis. If two GDRs are installed, an external MB splitter, supplied by the installer, may be used to route the MB signal to both GDR receivers. A Cobham (Comant) Model CI 509 or equivalent splitter is acceptable. The lamp indicators of the MB receiver are contained in the transmitted ARINC 429 Label 222 (VOR) and the RS-232 message ID V33. No discrete lamp drivers are provided.

P. **Marker audio:** The GDR has a separate MB audio output for connection to the aircraft's audio system. Audio volume control is available in the radio for single pilot operation when an audio panel is not available.

Q. **Marker thresholds:** The MB receiver has a HI and LO threshold factory set for -67 dBm and -53 dBm respectively. When am external splitter is installed, the installer may wish to compensate the MB thresholds for the loss. On installation, the threshold may be adjusted using the RS-232 ID V52, which is stored in non-volatile memory.

R. **Control buses:** The GDR radio has four (4) tuning buses, two RS-232, two RX ARINC 429 and one TX ARINC 429. The last bus tuned controls the radio, which is compatible with burst mode tuning.

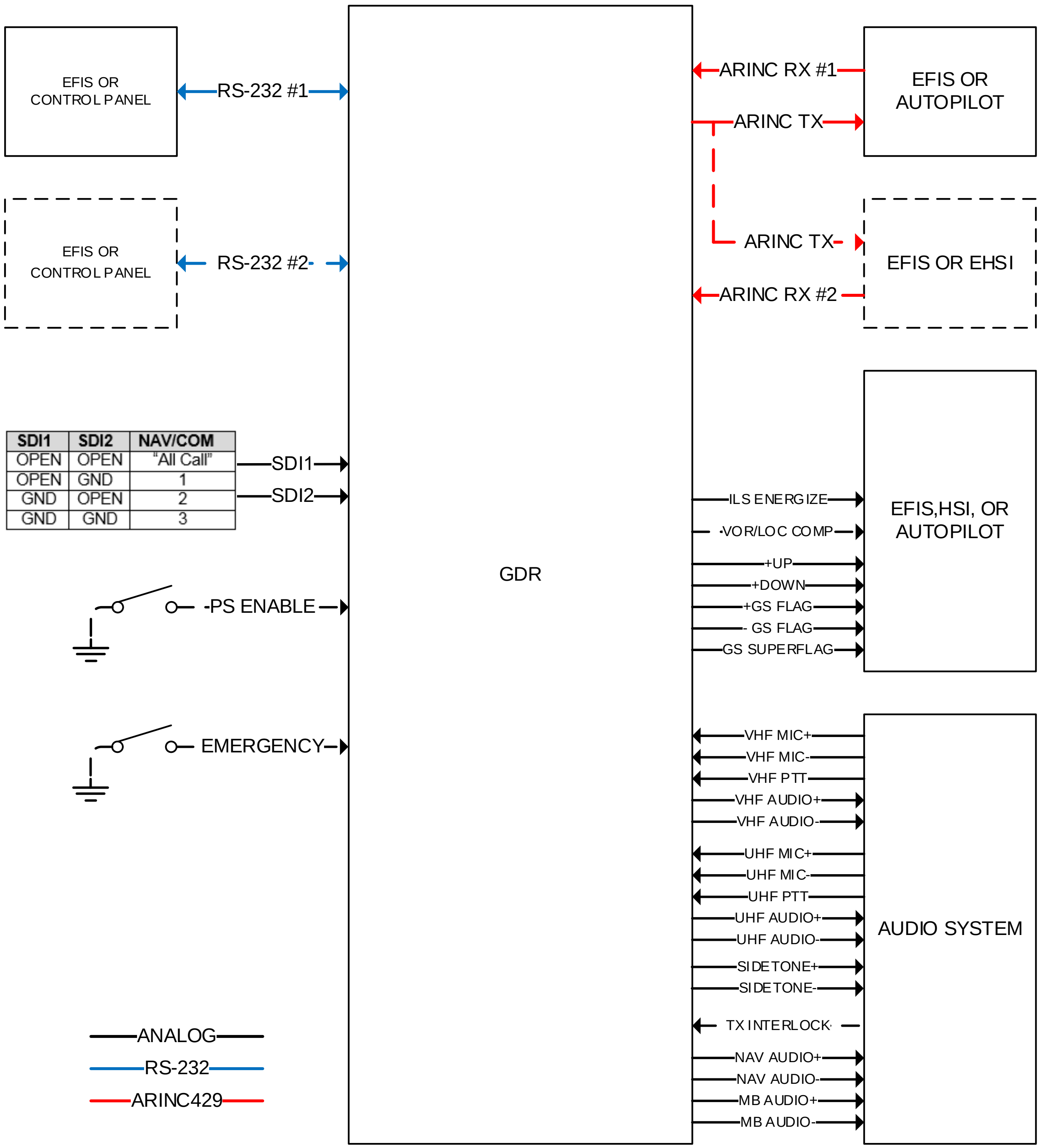


Figure 2: GDR System Block Diagram

8. SYSTEM COMPONENTS

The table below provides a list of specifications and major components (by part number) that make up the equipment system complying with the standards prescribed in all TSOs listed in Chapter 1, Section 10.

Table 3: List of Specifications and Major Components

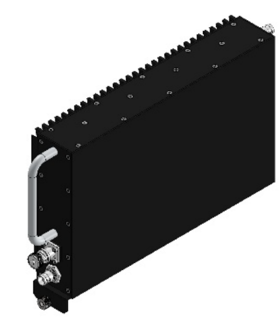
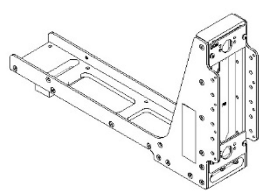
Component	Description	Part No.	Specifications		
			Dimensions	Weight	Power
	GDR-XXXXX	42-03300X-XXXX See Table 4	1.79"w 6.77"h 12.24"d	3.9 lbs.	8.0A TX mode 0.8A RX mode
	Single GDR Mounting Tray	42-033		0.60 lbs.	NA

Table 4 provides a part number breakdown for the currently defined radio configurations.

Table 4: GDR-XXXX Configuration

Part Number	Model Number	VOR/ILS	Marker Beacon	136MHz VHF	156MHz VHF	225-400MHz UHF	TX Power
42-033001-0001	GDR-1636	Y	Y	Y			16
42-033002-0001	GDR-1656	Y	Y		Y		16
42-033003-0001	GDR-1636U	Y	Y	Y		Y	16
42-033004-0001	GDR-1656U	Y	Y		Y	Y	16
42-033005-0001	GDR-2536	Y	Y	Y			25
42-033006-0001	GDR-2556	Y	Y		Y		25
42-033007-0001	GDR-2536U	Y	Y	Y		Y	25
42-033008-0001	GDR-2556U	Y	Y		Y	Y	25
42-033009-0001	GDR-1624U				Y	Y	16
42-033010-0001	GDR-2524U				Y	Y	25

CHAPTER 1 – INTRODUCTION

NOTE: Small parts and electrical components required for installation that are not specifically called out in the parts list, shall meet the requirements for aerospace use as “acceptable parts” or “standard parts. Selection of these parts shall be in accordance with guidance provided in FAA Advisory Circular 20-62D, Dated 5/24/96 (or later revision).

Table 5: GDR Installation Kit P/N 42-033100-0001

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	3010-10153-01	Connector, D-Sub, 37 Pin, Female, Swage Locknut
2	1	3010-10152-01	Connector, D-Sub, 15 Pin, Female, Swage Locknut
3	2	3010-10154-01	Connector, Coax, Rack Mount
4	1	9010-21457-01	Radio Mounting Tray
5	4	9000-21465-01	Screw, Modified, Shoulder, Hex, 4-40 x .266”L, SS
6	4	MS24693-C4	Screw, Phillips, 100° Flat, 4-40 x 3/8”L, SS
7	1	031-4427	Connector, BNC, Straight Crimp Plug, RG-400/U, 50

Table 6: List of Possible Antennas

Antenna function	**Vendor**	**Part number**	**Maximum Airspeed**	**Freq. Range**
Marker Antenna	Dayton Granger	EMB10-14	600 knots	75 MHz
	Comant	CI 102	400 knots	75 MHz
	Comant	CI 118	Not specified	75 MHz
VOR/LOC and GS Ant.	**Vendor**	**Part number**	**Maximum Airspeed**	**Freq. Range**
	Dayton Granger	VT10-56-6/15960		108-118 & 329-335 MHz
	Harris	DMN4-17N	Mach 1 "blade"	108-118 & 329-335 MHz
	Comant	CI 205-3	300 knots "towel bar"	108-118 & 329-335 MHz
	Comant	CI 120-400	300 knots "blade"	108-118 & 329-335 MHz
	Comant	CI 120 G/S	600 knots "blade"	108-118 & 329-335 MHz
COM Antenna	**Vendor**	**Part number**	**Maximum Airspeed**	**Freq. Range**
VHF COM:	Harris	DM C60-1	Not specified "Blade"	118-137 MHz
	Comant	C109	Not specified "whip"	118-137 MHz
	Harris	DM C63-1/A	Not specified "whip"	118-137 MHz
	Harris	DM C70-1/A	400 mph "Blade"	118-137 MHz
Extended VHF COM:	Harris	DM C60-17	Not specified "Blade"	118 -152 MHz
	Comant	CI-108-1	Not specified "Blade"	118-153 MHz
	Harris	DMC50	Mach 0.89 "Blade"	118-156 MHz
	Harris	DM C50-17	Not specified "Blade"	116-156 MHz
	Sensor Systems	S65-8280-18	Mach 0.85 "Blade"	116-156 MHz
VHF & UHF COM:	Sensor Systems	S65-8282-512	Mach 0.85 "Blade"	108-512 MHz
	Cooper Antenna	21-50-99	Mach 0.95 "Blade"	100-400 MHz

NOTE: This is list is provided as a reference only. It is up to the installer to determine suitability of each antenna for its intended purpose. The GDR radio should operate properly with any antenna meeting the appropriate TSO.

9. ELECTRICAL SPECIFICATIONS

Connector pin numbers for these inputs are listed in CHAPTER 3 – SYSTEM DRAWINGS.

A. Power Inputs

Receiver (NORM)	22 to 33 VDC, 1.0 Amps @ 22 VDC 27.5 VDC, 0.8 Amps typical
(EMER)	18.0 VDC, 1.2 Amps typical
Transmit (NORM)	22 to 33 VDC, 6.0 Amps @ 22 VDC 27.5 VDC, 5.7 Amps typical
(EMER)	18.0 VDC, 6 Amps typical

The Equipment shall provide the specified performance when operating on aircraft 28 VDC power supplies with characteristics and limits as specified in MIL-STD-704F.

B. System Antenna Specifications

COM Ant:	50 Ohm, 3:1 VSWR max., recommended ≤ 2.5:1 max.
Marker Ant:	50 Ohm, 1.5:1 VSWR max.
G/S Ant:	50 Ohm, 5.0:1 VSWR max., recommended ≤ 3.0:1 VSWR
NAV Ant:	50 Ohm, 5.0:1 VSWR max., recommended ≤ 3.0:1 VSWR

C. Antenna Inputs

COM	50 Ohm BNC
Marker Ant	50 Ohm BNC
G/S RX	50 Ohm BNC
NAV RX	50 Ohm BNC

D. Microphone Inputs (DO-214, § 1.5.2)

Impedance:	150 Ohm
Bias:	12 VDC, on MIC HI input
Input voltage range:	0.25 to 2.5 V_{RMS} for specified AM modulation 0.27 V_{RMS} recommended typical audio panel input level
Input type:	Differential, MIC HI to MIC LO

E. Audio Outputs and Levels

Audio Output Range:	<2 to 8 Vrms configurable in ~0.03 Volt steps
Output load:	150 to 600 Ohms capable
Output balance:	Floating differential or single-ended with negative side grounded
Audio power:	Production set 100 mW into 150 Ohms, output voltage must be reset for other impedances.
Marker audio output:	3.87 ± 0.50 V_{RMS}, 100 mW, 150 Ohms
VOR/LOC audio output:	3.87 ± 0.50 V_{RMS}, 100 mW, 150 Ohms
VHF COM audio output:	3.87 ± 0.50 V_{RMS}, 100 mW, 150 Ohms
UHF COM audio output:	3.87 ± 0.50 V_{RMS}, 100 mW, 150 Ohms
Sidetone audio output:	3.87 ± 0.50 V_{RMS}, 100 mW, 150 Ohms
Combined Sidetone:	Set -6 dB below received RX audio level, see note.

Note: When Sidetone is combined with the normal receiver output, the Sidetone will be -6 dB or 25 mW at 0.25 V_{RMS} audio input.

10. ENVIRONMENTAL SPECIFICATIONS

The GDR-XXXX meets the following environmental testing requirements from DO-160F:

Sec.	Condition	Cat.	Test Category Description	Notes
4.0	Temperature and Altitude	F2	Equipment intended for installation in a non-pressurized but controlled temperature location on an aircraft that is operated at altitudes up to 50,000 ft. MSL.	Operating High: +70˚C Operating Low: -55˚C Ground Survival High: +85˚C Ground Survival Low: -55˚C Altitude: 50,000 feet
4.5.5	In-Flight Loss of Cooling	X	No cooling is required	
4.62 4.63	Decompression and Overpressure	X		
5.0	Temperature Variation	A	Equipment external to the aircraft or internal to the aircraft at 10°C/min.	
6.0	Humidity	B	Equipment intended for installation in civil aircraft, non-civil transport aircraft and other classes, within non-environmentally controlled compartments of aircraft in which more severe humidity environment may be encountered.	
7.0	Operational Shocks & Crash Safety	B	Equipment generally installed in fixed-wing aircraft or helicopters and tested for standard operational shock and crash safety.	
8.0	Vibration	S U2	U - (Helicopter w/Unknown Frequencies) Demonstrates performance at higher vibration levels and after long term vibration exposure for fuselage and instrument panel equipment when the specific rotor frequencies are unknown.	Fixed wing sine curve M & B Random vibration curves F&F1
9.0	Explosive Atmosphere	X		
10.0	Waterproofness	W	Equipment is installed in locations where it may be subjected to falling water, such as condensation.	
11.0	Fluids Susceptibility	X		
12.0	Sand and Dust	S	Equipment installed in locations where the equipment is subjected to blowing dust in the course of normal aircraft operations.	
13.0	Fungus Resistance	F	Demonstrate whether equipment material is adversely affected by fungi growth.	By Analysis
14.0	Salt Fog	S		
15.0	Magnetic Effect	Z	Magnetic deflection distance less than 0.3m.	
16.0	Power Input	Z	DC equipment intended for use on aircraft electrical systems supplied by engine-driven alternator/rectifiers, or DC generators where a battery of significant capacity is floating on the DC bus at all times.	

Sec.	Condition	Cat.	Test Category Description	Notes
17.0	Voltage Spike	A	Equipment intended primarily for installation where a high degree of protection against damage by voltage spikes is required.	
18.0	Audio Frequency Conducted Susceptibility-Power Inputs	Z	Equipment intended primarily for installation where a high degree of protection against damage by voltage spikes is required.	
19.0	Induced Signal Susceptibility	ZC	Equipment intended primarily for operation in systems where interference-free operation is required on aircraft whose primary power is constant frequency (DC).	
20.0	Radio Frequency Susceptibility (Conducted and Radiated)	W/WR	Equipment and interconnecting wiring installed in severe electromagnetic environments and to show compliance with the interim HIRF rules. Includes JAA INT/POL AC/AMJ 20.1317	Conducted: Cat. W & G Radiated: Cat. W, R, & G .
21.0	Emission of Radio Frequency Energy	M	Equipment in areas where apertures are EM significant but not in direct view of aircraft antennas, such as passenger cabin or cockpit.	
22.0	Lightning Induced Transient Susceptibility	A3J3L3	Equipment interconnected with shielded wiring installed within any airframe or airframe section where apertures, not structural resistance are a significant source of induced transients. Level 3 designates equipment and interconnecting wiring installed in a moderately exposed environment.	All wires (including discretes) shielded and heavily grounded.
23.0	Lightning Direct Effects	X	Not Applicable	
24.0	Icing	X	Not Applicable	
25.0	Electrostatic Discharge (ESD)	A	Electronic equipment that is installed repaired or operated in an aerospace environment.	
26.0	Fire, Flammability	C	Non-metallic equipment, component parts, sub-assemblies installed in pressurized or non-pressurized zones and non-fire zones with largest dimension greater than 50 mm.	By Analysis

11. TSO APPLICABILITY

The GDR-XXXX is an incomplete system for each of the TSOs listed below.

TSO	Title	MOPS
TSO-C34e	ILS Glideslope Equipment Operating within the Radio Frequency Range of 328.6-335.4 MHz (Class D)	RTCA/DO-192
TSO-C35d	Airborne Radio Marker Receiving Equipment (Class A)	RTCA/DO-143
TSO-C36e	Airborne ILS Localizer Receiving Equipment Operating within Radio Frequency Range of 108-112 MHz	RTCA/DO-195
TSO-C40c	VOR Receiving Equipment Operating within Radio Frequency Range of 108-117.95 MHz	RTCA/DO-196
TSO-C128a	Devices That Prevent Blocked Channels Used in Two-Way Radio Communication Due to Unintentional Transmission.	RTCA/DO-207
TSO-C169a	VHF Radio Communication Transceiver Equipment Operating within the Radio Frequency Range 117.975 to 137.000 MHz.	RTCA/DO-186B

12. TSO DEVIATIONS

The following TSO deviations have been granted for the GDR-XXXX.

TSO	TSO Deviation

13. ACRONYMS AND ABBREVIATIONS

The following acronyms may appear in this document.

AC	Advisory Circular, Alternating Current
A/C	Aircraft
AD	Airworthiness Directive
ADF	Automatic Direction Finding
AFM	Aircraft Flight Manual
ANSI	American National Standards Institute
ARINC	Aeronautical Radio, Inc.
ARP	SAE Aerospace Recommended Practice
AS	SAE Aerospace Standard
C	Centigrade
CAR	Civil Air regulations
COM	Communication
CPU	Central Processing Unit
D-A	Digital to Analog (converter)
dB	Decibel
DC	Direct Current
DME	Distance Measuring Equipment
DO	RTCA Document
EFIS	Electronic Flight Instrument System
EIA	Electronics Industry Association
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FMS	Flight Management System
FSD	Full Scale Deflection
GDR	Genesys Digital Radio
GND	Ground (potential)
GS	Glideslope
IC	Integrated Circuit
ICAO	International Civil Aviation Organization
ID	Identity or Identification
IDU	Integrated Display Unit
ILS	Instrument Landing System
JTAG	Joint Test Action Group (IEEE 1149.1 Standard)
K	Kilo=1000
KB	Kilobyte
KHz	Kilo-Hertz
LOC	Localizer
LRU	Line Replaceable Unit
LSB	Least Significant Bit or Byte
M	Meters
MB	Marker Beacon
MFD	Multifunction Display (an IDU with software for showing multiple display screens)
MIC	Microphone
MIL	Military
MHz	Mega-Hertz
MOPS	Minimum Operational Performance Standard
MSB	Most Significant Bit or Byte
MSL	Mean Sea Level
MTBF	Mean Time Between Failures
NAS	U.S. National Airspace System
NAV	Navigation
Nm	Nautical Mile
OBS	Omni-bearing Selector
PN	Part Number
PTT	Push-To-Talk
RS	EIA Recommended Standard
RTCA	Radio Telephone Commission for Aeronautics
RX	Receive
SAE	Society of Automotive Engineers
SDI	Source/Destination Identifier
SN	Serial Number
SNI	Serial Number Information
STC	Supplemental Type Certificate
TSO	Technical Standard Order
TX	Transmit
UHF	Ultra High Frequency
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	Very High Frequency Omnidirectional Radio

THIS PAGE IS BLANK

CHAPTER 2 – SYSTEM INSTALLATION

CAUTION: It is critically important that this installation manual be read and understood completely and thoroughly before starting component installation and wiring.

A successful installation should begin with careful consideration and planning of mounting locations, cable routing and any associated airframe modifications that may be required.

The conditions and tests required for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type of class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have a separate approval for installation in an aircraft. This article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements.

14. LIMITATIONS AND NOTES

A. Notes and Warnings

NOTE: No special airworthiness limitations exist. Maintenance is required per FAR 43.16 and FAR 91.403.

15. PRE-INSTALLATION INFORMATION

A. Always follow good avionics installation practices per FAA Advisory Circulars 43.13-1B, 43.13-2A, and AC 23-1311-1A or later FAA approved revisions of these documents.

B. Follow the installation procedures in this chapter as it is presented for a successful installation. Read and understand the entire chapter before beginning the installation procedures. Perform the post installation checkout before closing the work areas in case problems occur.

C. Complete an electrical load analysis on the aircraft prior to starting modification to ensure the aircraft electrical system has the ability to carry the GDR electrical load per AC 43.13-1B, Chapter 11. Refer to Chapter 1, Table 3 for the power consumption of each component. Record the aircraft electrical load; identify system configuration and location of equipment on FAA Form 337.

CHAPTER 2 – SYSTEM INSTALLATION

16. CABLING TERMINATION

A. General

(1) Terminate all individual cable shields which are not “dead ended” using a solder sleeve and braided pigtail (equivalent in cross section to shield braid with center conductors removed) or optionally the braid pull-out method. Use the smallest solder sleeve that will fit over the cable shield and the braid pigtail.

(2) The shield pigtail may be either a wire segment (of sufficient diameter equivalent to shield braid with center conductors removed) or another small braid segment. Wire segments are used when the cable shield is terminated to a connector contact or a terminal lug. Braid segments are used when the cable shield terminates at a back shell or EMI spigot, terminal lug, or split support ring used to terminate a braid sock. ZAP assemblies with multiple terminations may use either wire pigtails, braid pigtails or a combination of both.

(3) For back shell shield terminations, the individual cable shield shall be terminated at the end of the cable maintaining the minimum length of unshielded conductors with the shield pigtail installed at the back end. The solder sleeve may end up inside the back shell depending on the length of the unshielded portion of the cable.

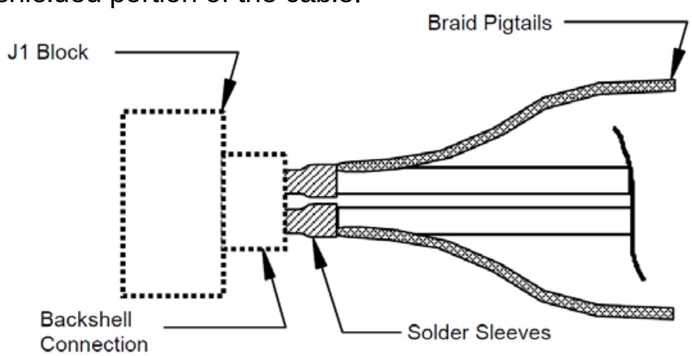


Figure 3: Solder Sleeve Assembly

B. Solder Sleeve Assembly

(1) Remove the outer jacket using a thermal stripper or other suitable means, exposing 0.25 to 0.38 inch of shield braid.

(a) When using a suitable tool other than a thermal stripper to remove jacket, score jacket lightly and bend cable to complete jacket separation. Do not cut completely through cable jacket.

<u>CAUTION:</u> Cutting through the cable jacket may result in damage to shield.

CHAPTER 2 – SYSTEM INSTALLATION

(2) Push the solder sleeve over the exposed shield braid so solder sleeve shall be approximately centered over the exposed shield braid.

(a) To avoid heat concentration which might split or otherwise damage the solder sleeve, the end of the shield ground wire insulation, if not preinstalled, should be positioned approximately even with the inner edge of the seal ring.

(b) Maintain the relative position of the solder sleeve, shield ground wire and shield braid during assembly.

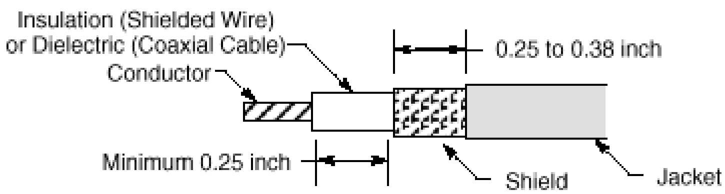


Figure 4: Wire Termination

(c) Use tinned copper braid Alpha P/N 1223 (3/64 inch) or equivalent for pigtail. Lap pigtail braid or wire segment with wire shield and place solder sleeve over assembly.

(d) Shrink the solder sleeve in accordance using infrared or hot air heaters. Apply the heat uniformly, periodically rotating the solder sleeve during the heating process. Do not allow the infrared or hot air heater to touch the solder sleeve or wire during the heating process (touching of the heating guard is acceptable).

(e) Inspect for conformance to criteria for installed solder sleeves per the following:

(i) No appearance of the solder perform ring will remain.

(ii) In the case of solder sleeves with indicator rings the following also applies: It is necessary that the indicator ring has completely disappeared or melted.

NOTE: If the process continually results in less than 100 percent melting of the indicator ring there may be a problem with the process which should be corrected before further processing.

– If infrared heating is used, the problem is usually caused by a dirty reflector.

– If hot air is used, the sleeve may not be centered in the hot air reflector.

(iii) The shield ground wire shall be approximately centered in the melted area.

(iv) Preformed solder ring inserts are to melt and flow along the shield ground wire leads and shield.

(v) A minimum 0.125 inch fillet length is visible under a maximum power of 4X magnification along the shield ground wire lead and shield junction on at least one side of the shield ground wire. This requirement also applies to each shield ground wire of a multiple shield ground wire termination.

(vi) Browning or darkening of the sleeve is acceptable unless this condition inhibits visibility of the solder termination.

(vii) The materials must not be split, charred, or otherwise damaged to any extent that that would compromise the insulating integrity of the sleeve.

(viii) Inserts are to melt and flow around the circumference of the cable between the cable jacket and the insulation sleeve to prevent solder from flowing out of the work area.

(ix) The melted insert rings must not obstruct visual inspection of the solder joint.

(x) A maximum of 1/2 inch wicking up the shield ground wire (measured from the shield ground wire end of the sleeve) is allowed.

C. Optional Shield Pull-Out Method

(1) Do not use this procedure for a shield that has flat conductor braid strands.

(2) Remove the cable outer jacket to the point of breakout.

(3) Using a non–metallic awl or similar tool, start a small hole in the shield braid approximately 0.5 inch from end of outer jacket by spreading the shield carriers slightly.

(4) Push the shield braid back on the wire(s) to cause it to bunch.

(5) Widen the hole in the shielding by alternately pushing shield carriers back in each direction.

(6) As the hole enlarges, start bending the wire(s) slightly to allow shield carriers to be worked down over the bent wire(s) until the wire(s) can be

pulled through the opening. During this operation, avoid damage to braid and conductor insulation.

(i) Do not overstress individual shield strands causing breakage.

(ii) Do not subject the conductors to a bend radius less than 3 times the insulation diameter.

(7) Work the bunched shielding back down the wire and straighten the shield ground wire to its full length.

(8) Cut the shield ground wire to a maximum length of 2.0 inches.

(9) Protect shield breakout area using M23053/5 sleeving.

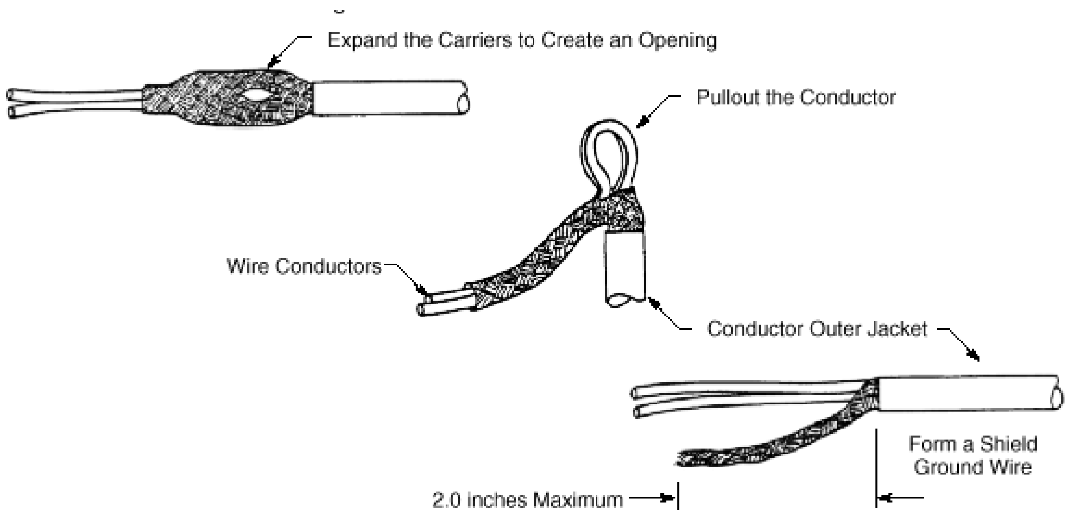


Figure 5: Shield Pull-Out Method

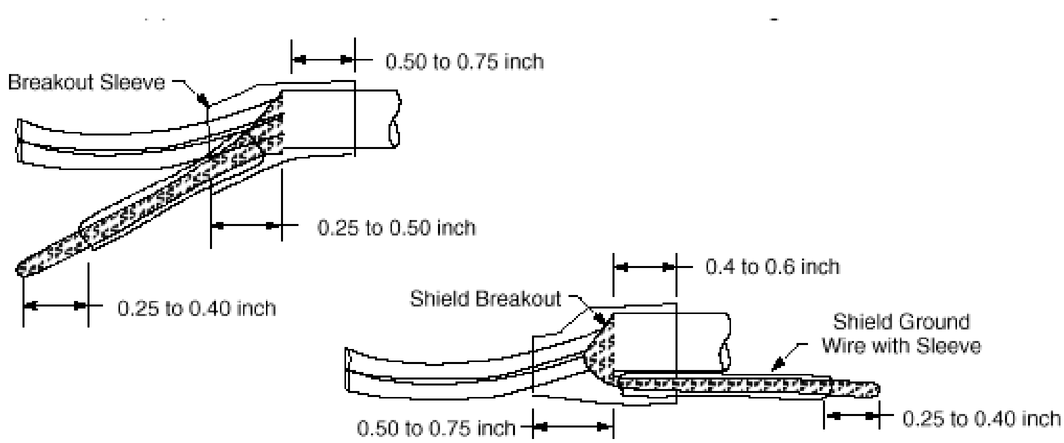


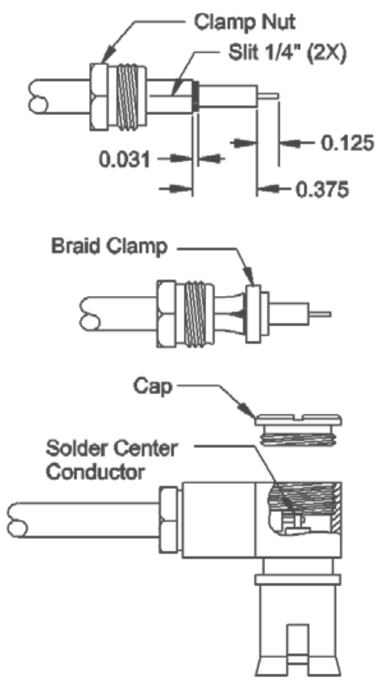
Figure 6: Shield Pull-Out Method (Continued)

D. Back Shell Termination

E. Right Angle BNC Connector Assembly

The NAV and COM coaxial cables terminate in a right-angled BNC connector that is mounted on the tray assembly.

Assembly instructions for right angle connector part #3010-10154-01



Step 1
- Slide clamp nut over coax
- Strip coax as illustrated
- Cut two 1/4" slits in jacket 180 degrees apart.

Step 2.
- Slide braid clamp over end of coax and under the braid.

Step 3.
- Insert coax with braid clamp into the connector and tighten clamp nut securely.
- Solder the center conductor of the coax to the contact as illustrated.
- Attach the cap and secure tightly.

Figure 7: Right Angle BNC Connector

CHAPTER 2 – SYSTEM INSTALLATION

17. MOUNTING

A. Tray Installation

Use the following guidelines in locating and mounting the tray assembly in the aircraft. See Chapter 3 for tray mechanical dimensions.

- For normal operation, it is preferred the GDR be mounted in a temperature controlled environment between -20°C and +55°C.
- The GDR may be mounted in the pressure vessel. The GDR contains no batteries or potentially explosive components.
- The tray assembly may be mounted in the normal (mounting screws down), inverted, or on its side.
- The GDR should be located within 20 feet of the NAV display system (EFIS or HSI) and audio control system.
- Burnish and apply an electrical bonding agent to the mounting surface area that will be contacting the mounting tabs of the tray assembly.
- Install the tray assembly using four (4) 8-32 screws (MS27039-0807) and four (4) #8 washers (NAS1149F0832P) or equivalent with installer supplied AN, MS, or NAS nuts, nut clips, or nut plates as required.
- Use four (4) self-locking nuts (AN365) or equivalent, nut plates, or #8 threaded inserts to secure the tray assembly to the airframe.
- Verify resistance between the tray assembly chassis and airframe ground is less than 2.5 milliohms.

Upon determination of a suitable existing shelf, or completion of a new equipment shelf, a static load test must be performed per AC 43.13-2A, Chapter1, §2 and §3 to determine proper load bearing and security of the equipment. A typical aircraft operating in Normal FAR 23 (CAR 3), Normal FAR 27 (CAR 6), Transport FAR 25 (CAR 4b), or Transport FAR 29 (CAR 7) category will require a test of the shelf as follows:

	Fixed Wing		Rotorcraft	
Direction of Pull	**Load Factor**	**Static Test Load (*Load factor x GDR-XXXX Weight*)**	**Load Factor**	**Static Test Load (*Load factor x GDR-XXXX Weight*)**
Sideways	4.5g	(4.5 x 4.5) = 20.2 lbs.	8.0g	(8.0 x 4.5) = 36.0 lbs.
Upwards	7.0g	(7 x 4.5) = 31.5 lbs.	4.0g	(4.0 x 4.5) = 18.0 lbs.
Forwards	18.0g	(18 x 4.5) = 81.0 lbs.	16.0g	(16.0 x 4.5) = 72.0 lbs.
Downwards	10.0g	(10 x 4.5) = 45.0 lbs.	20.0g	(20.0 x 4.5) = 90.0 lbs.
Backwards			1.5g	(1.5 x 4.5) = 6.8 lbs.

The installer will make a simple test jig that will be used to measure the static test loads as shown in the table above. Perform the tests at the center of gravity of the GDR-XXXX and record the completion of the test in the Ground Maintenance section of this manual. An acceptable installation will show no signs of permanent deformation after 3 seconds of applied pressure in all directions of pull.

B. Tray Assembly

The tray assembly provides the mounting for the electrical connectors and coax cable connectors. Hardware to mount the connectors is contained in the Installation Kit.

- Install
- Group wires to P1 together and secure to

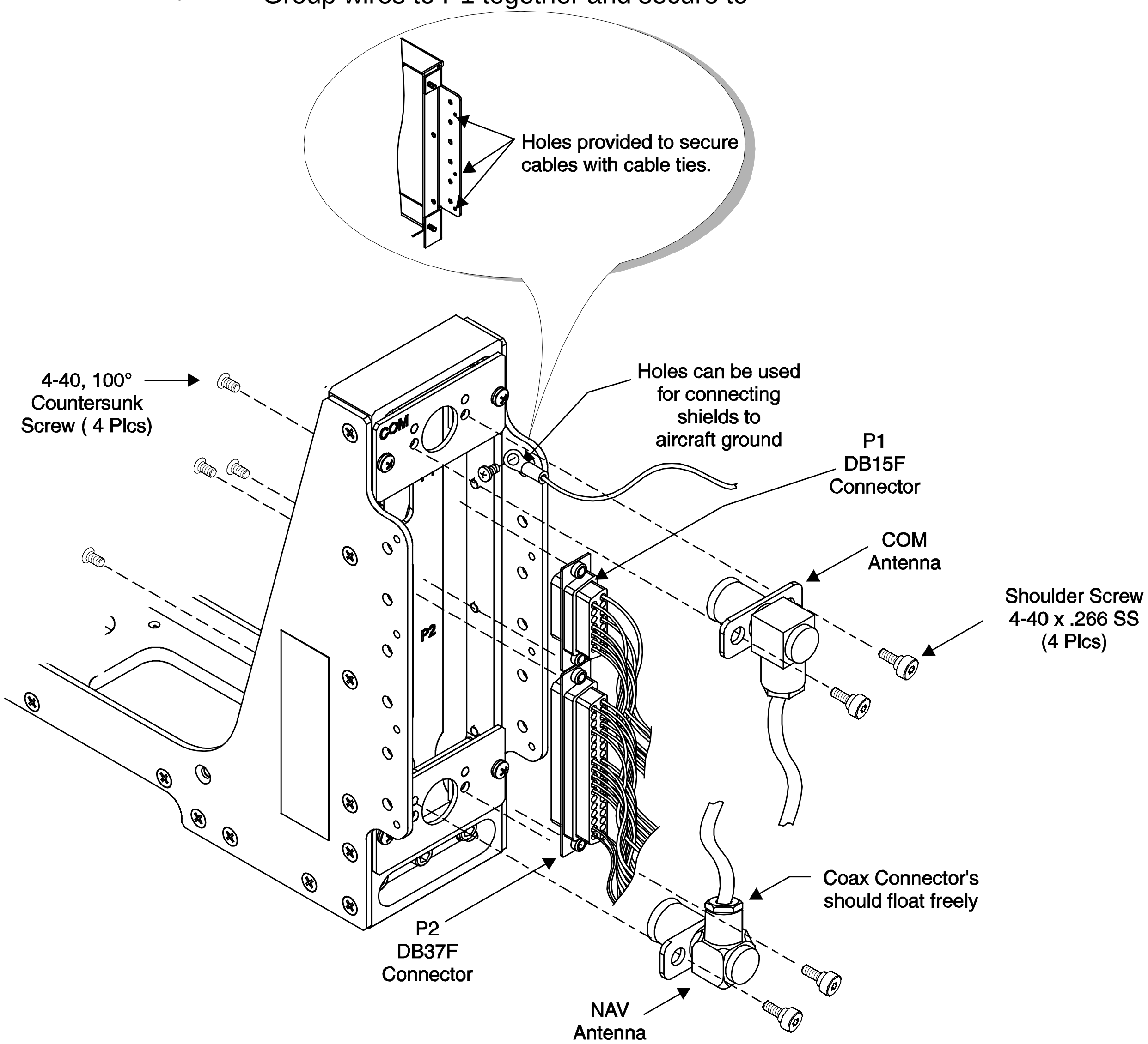


Figure 8: Tray Assembly

18. ANTENNA LOCATION

A. COM Antenna

The GDR requires a 50 Ohm vertically polarized COM antenna compliant with TSO-C169. The COM antenna should cover the COM frequencies appropriate for your model number. Some possible antennas are listed in Table 7, Table 8, and Table 9.

- Use RG-400 or equivalent, not to exceed 2 dB of signal loss.
- The COM antenna should be mounted on the centerline of the airframe, at least 3 feet from other antennas.
- In multiple GDR installations, one antenna should be mounted on the bottom centerline of the airframe and the other antenna should be mounted on the top centerline of the airframe.
- Avoid sharp bends of the coax.
- Do not route the COM coax near ADF antenna cables.
- Maintain at least a 2 foot distance between COM and NAV coaxial cables when routed parallel to each other.

CAUTION:

- The installer must ensure that the antenna is placed such that radiation exposure to aircraft personnel is limited to 0.2 mWatt/cm^2 to conform to the FCC safe exposure limit. This may be measured or calculated. For direct line of sight spacing the following formula may be utilized:

$$Power_{\ Exposure} = \frac{Power_{effective}}{4\pi R^2}\ mW/cm^2$$

In this formula, R is the distance from the antenna. The effective transmit power is found by adjusting the transmitter power for the antenna gain in milli-Watts. For a 25 Watt radio with an antenna gain of 3 dBi, the corrected transmit power is 49,881 mW. This gives a minimum safe distance of 141 cm.

Table 7: List of VHF COM Antennas

Vendor	Part Number	Maximum Airspeed	Freq. Range
Harris	DM C60-1	Not specified "Blade"	118-137 MHz
Comant	C109	Not specified "whip"	118-137 MHz
Harris	DM C63-1/A	Not specified "whip"	118-137 MHz
Harris	DM C70-1/A	400 mph "Blade"	118-137 MHz

Table 8: List of Extended Range VHF COM Antennas

Vendor	Part Number	Maximum Airspeed	Freq. Range
Dayton Granger	VF10-347	600 knots "Blade"	116-150 MHz
Harris	DM C60-17	Not specified "Blade"	118 -152 MHz
Comant	CI-108-1	Not specified "Blade"	118-153 MHz
Harris	DMC50	Mach 0.89 "Blade"	118-156 MHz
Harris	DM C50-17	Not specified "Blade"	116-156 MHz
Sensor Systems	S65-8280-18	Mach 0.85 "Blade"	116-156 MHz

Table 9: List of Combined VHF & UHF COM Antennas

Vendor	Part Number	Maximum Airspeed	Freq. Range
Sensor Systems	S65-8282-512	Mach 0.85 "Blade"	108-512 MHz
Cooper Antenna	21-50-99	Mach 0.95 "Blade"	100-400 MHz

B. NAV Antenna

The GDR requires a 50 Ohm horizontally polarized navigation VOR/LOC/GS antenna meeting TSOs TSO-C34e, TSO-C36e, and TSO-C40c. Some possible antennas are listed in Table 10.

- An external diplexer for VOR/LOC and GS signals is not required for a combined NAV and GS antenna. The GDR contains an internal diplexer to split the GS signal from the VOR/LOC signal.
- Use RG-400 or equivalent, not to exceed 2 dB of signal loss.
- The antenna must be mounted symmetrically with the centerline of the airframe and should have a clear line of sight in front of the aircraft.
- In multiple GDR installations, a splitter may be used for the VOR/LOC and GS signals to route signals to both GDR inputs. A Sensor Systems P/N SSPD-113-10, or equivalent is recommended for this splitter.
- When using a splitter, the coax from the antenna will be routed to the “REC” port of the splitter and the coax from each GDR will be routed to one of the “ANT” ports of the splitter.
- Avoid sharp bends of the coax.
- Maintain at least a 2 foot distance between NAV and COM coaxial cables when routed parallel to each other.

Table 10: List of NAV Antennas

Vendor	Part Number	Maximum Airspeed	Freq. Range
Dayton Granger	VT10-56-6/15960		108-118 & 329-335 MHz
Harris	DMN4-17N	Mach 1 "blade"	108-118 & 329-335 MHz
Comant	CI 205-3	300 knots "towel bar"	108-118 & 329-335 MHz
Comant	CI 120-400	300 knots "blade"	108-118 & 329-335 MHz
Comant	CI 120 G/S	600 knots "blade"	108-118 & 329-335 MHz

C. MB Antenna

The GDR requires a 50 Ohm horizontally polarized Marker Beacon antenna meeting TSO-C36e. Some possible antennas are listed in Table 11.

- Use RG-400 or equivalent, not to exceed 2dB of signal loss.
- Antenna should be mounted on the bottom of the aircraft, along the centerline of the airframe at least 3 feet from other antennas.
- In multiple GDR installations, a Comant CI 165 dual Marker Beacon antenna (or equivalent) may be used.
- Avoid sharp bends of the coax.
- Maintain at least a 2 foot distance between MB and NAV or COM coaxial cables when routed parallel to each other.

Table 11: List of MB Antennas

Vendor	Part Number	Maximum Airspeed	Freq. Range
Dayton Granger	EMB10-14	600 knots	75 MHz
Comant	CI 102	400 knots	75 MHz
Comant	CI 118	Not specified	75 MHz

19. SIGNAL DESCRIPTION

Use of the following signals will be determined by the avionics and audio panel interface.

A. Power and Ground

In receive mode, maximum current draw is 1.0 A. When one COM channel is transmitting, maximum current draw is 8.0 A.

Conn	Pin	Description
P1	1	POWER (+28VDC)
P2	1	POWER (+28VDC)
P1	9	GROUND
P2	2	GROUND

B. RS-232 Interface

The GDR contains two RS-232 communications ports. Both ports can be connected to an EFIS or Radio Management Unit to set frequencies, volumes, and other modes of the COM, NAV, and MB. The GDR will use the last valid data from any tuning port. The data used on these ports is proprietary and is intended to be used by Genesys equipment.

Conn	Pin	Description
P2	3	RS-232 #1 GND
P2	4	RS-232 #1 RX
P2	5	RS-232 #1 TX
P2	26	RS-232 #2 RX
P2	34	RS-232 #2 TX
P2	37	RS-232 #2 GND

C. ARINC 429 Interface

The GDR contains two ARINC 429 receive ports and one ARINC 429 transmit port. Either ARINC429 receive port may be used to control the VHF, UHF, NAV, and MB receivers. The GDR will use the last valid data from either port. Burst mode operation is recommended, which will allow a combination of RS-232 and ARINC tuning when required.

Conn	Pin	Description
P2	15	ARINC 429 RX#1 A
P2	16	ARINC 429 RX#1 B
P2	17	ARINC 429 RX#2 A
P2	18	ARINC 429 RX#2 B
P2	21	ARINC 429 TX A
P2	22	ARINC 429 TX B

The ARINC 429 transmit port is used to send COM, VOR/LOC, GS, and MB data and/or status. The following ARINC 429 labels are accepted and/or transmitted by the GDR. Please refer to APPENDIX A – ARINC 429 SPECIFICATIONS for bit definition and other details on each ARINC 429 label.

ARINC LABEL	NAME	ARINC RX#1	ARINC RX#2	ARINC TX	NOTES
030	VHF COM FREQ.	X	X	X	25 KHz tuning
034	VOR/ILS FREQ.	X	X	X	
035	DME FREQ.			X	
040	UHF COM FREQ.	X	X	X	
047	VHF COM FREQ.	X	X	X	8.33KHz tuning
173	LOC DEVIATION			X	
174	GS DEVIATION			X	
222	VOR BEARING			X	Includes MB
242	VOR STATION ID			X	1st word Morse code
244	VOR STATION ID			X	2nd word Morse code
263	ILS STATION ID			X	1st word Morse code
264	ILS STATION ID			X	2nd word Morse code
350	LRU MAINTENANCE			X	BIT status of GDR

D. MIC Audio

There are two microphone audio inputs to the GDR. In dual radio mode, the VHF MIC is used for VHF transmission and the UHF MIC is used for UHF transmission. In single radio mode, only the UHF mic input is used for both bands.

The MIC input has a 150 Ohm impedance, biased at 12 VDC on MIC+, and has an input range of 0.25 to 2.50 Vrms for full modulation. A typical input setting of 0.27 Vrms is recommended, which minimizes cabin noise.

Conn	Pin	Description
P1	7	VHF MIC-
P1	8	VHF MIC+
P1	10	UHF MIC+
P1	11	UHF MIC-

E. COM Audio and SIDETONE

The UHF and VHF bands have separate RX audio outputs and are configurable to combined Sidetone on these outputs. Both bands have a shared Sidetone output, when Sidetone level control by the audio panel is desired. The GDR must be configured to provide Sidetone on the receiver output.

All audio outputs are floating differential, but may be installed single-ended with the negative output grounded if required. Differential connection to the audio panel is recommended for noise immunity.

Each COM audio output can generate up to 100 mW into a 600 Ohm load or 7.75 ± 0.5 Vrms. Normal production setting is for 100 mW into 150 Ohm load at 3.87 ± 0.5 Vrms. Desired audio levels depend on the audio panel and headset impedance used in the aircraft. If the audio panel has an emergency mode, the radio may be required to drive the headset directly and may require a different audio output level.

CHAPTER 2 – SYSTEM INSTALLATION

Conn	Pin	Description
P1	2	SIDETONE+
P1	3	SIDETONE-
P1	5	UHF AUDIO-
P1	6	UHF AUDIO+
P1	13	VHF AUDIO-
P1	14	VHF AUDIO+

F. PTT and TX INTERLOCK

The VHF and UHF transceivers have separate Push-To-Talk (PTT) inputs, except when configured for single radio mode. Each PTT input has an impedance of 7.9k Ohms and requires a voltage below 2.0 VDC to be active.

The Transmit Interlock discrete input is available in installations where a co-located transmitter's noise floor opens the receiver's squelch during transmit. This can occur when COM to COM antenna separation is limited. If this occurs, all receiver's TX interlock may be diode ORed with the PTT to the audio panel. This feature is also available in select audio panels.

When the Transmit Interlock input is pulled low, this inserts a 10 dB pad at the input of the COM receivers and enables the TX Squelch level settings. This reduces the sensitivity of the receiver during transmit and allows an alternate squelch setting during transmit when required. The need for this feature is determined by the location of antennas and the noise floor of the offending transmitter.

CAUTION: The TX Interlock pin of all radios cannot sink any current otherwise TX Interlock will be permanently active unless an external pull up resistor is installed.

Conn	Pin	Description
P1	4	VHF PTT
P1	12	UHF PTT
P1	15	TX INTERLOCK

G. NAV and MB AUDIO

The NAV (VOR/LOC) and MB receivers each have separate balanced audio outputs. Each output can generate 100 mW into a 600 Ohm load at 7.75 ± 0.5 Vrms. Normal production setting is for 100 mW into 150 Ohm load at 3.87 ± 0.5 Vrms.

Conn	Pin	Description
P2	20	NAV AUDIO-
P2	23	NAV AUDIO+
P2	24	MB AUDIO+
P2	25	MB AUDIO-

H. SDI, Power, and Discrete

Two pins on the P2 connector are used to set the ARINC 429 Source/Destination Identifier (SDI), one pin is used to remotely turn on the radio, and one pin to tune to the Emergency frequency.

An open condition is valid when the input is above 12VDC. A ground condition is valid when the input is below 2VDC.

The two SDI pins are used to identify the identification of the radio for the ARINC 429 words. The combination of SDI1 and SDI2 will determine NAV/COM1 through NAV/COM3 as noted below.

SDI1	SDI2	NAV/COM
OPEN	OPEN	“All Call”
OPEN	GND	1
GND	OPEN	2
GND	GND	3

The PS ENABLE pin enables the power supply of the radio on when grounded. This pin may be wired to a control head power switch or permanently wired to ground. When permanently wired to ground, the unit will activate when 28 Volt power is applied.

The EMERGENCY pin will tune the VHF and UHF transceivers to the emergency frequency of 121.5MHz (VHF) and 243.00MHz (UHF) when grounded.

Conn	Pin	Description
P2	7	SDI1
P2	8	SDI2
P2	35	PS ENABLE
P2	36	EMERGENCY

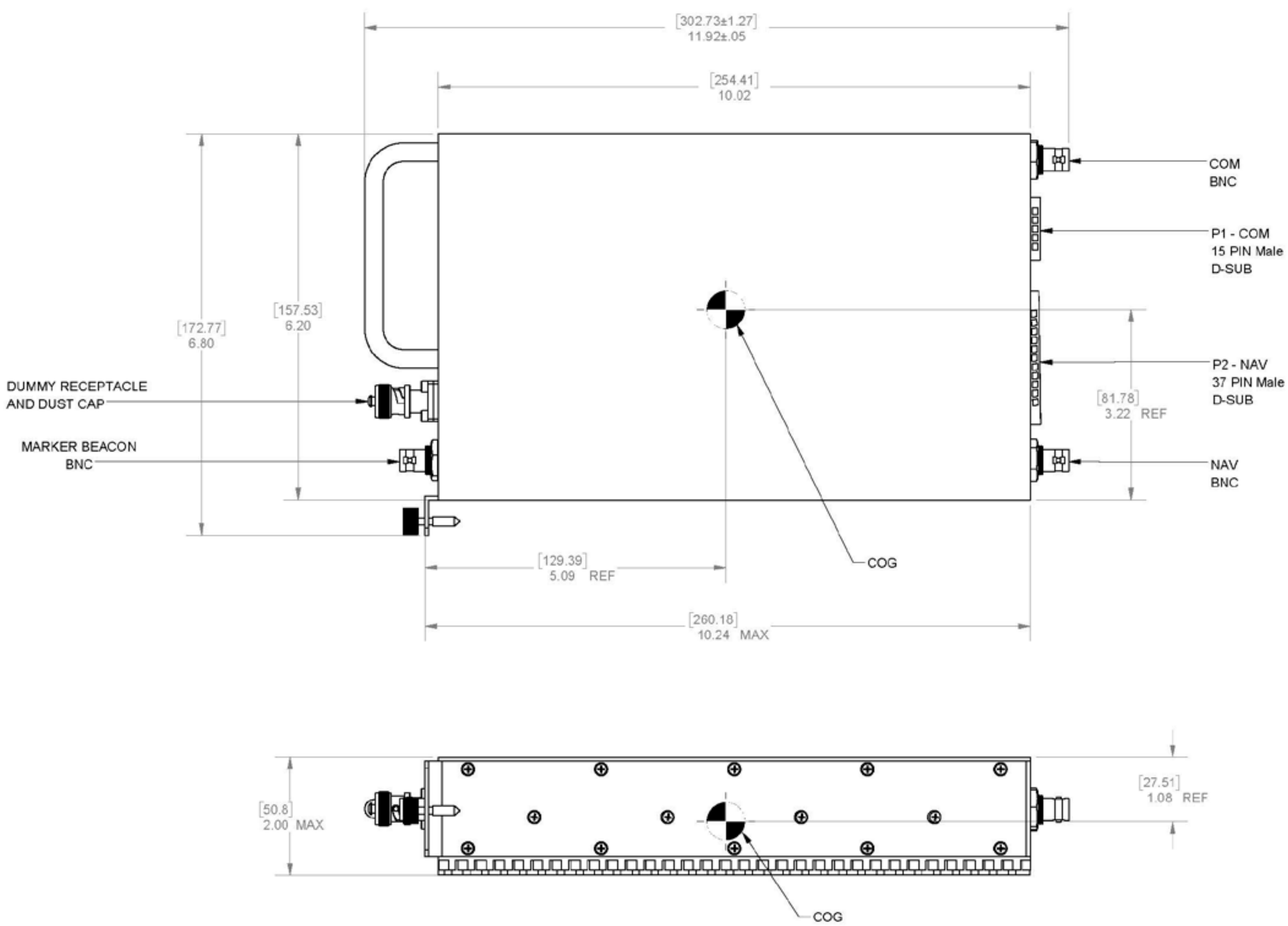
CHAPTER 3 – SYSTEM DRAWINGS

This section contains the drawings of the GDR-XXXX and electrical connectors.

20. MECHANICAL DRAWING

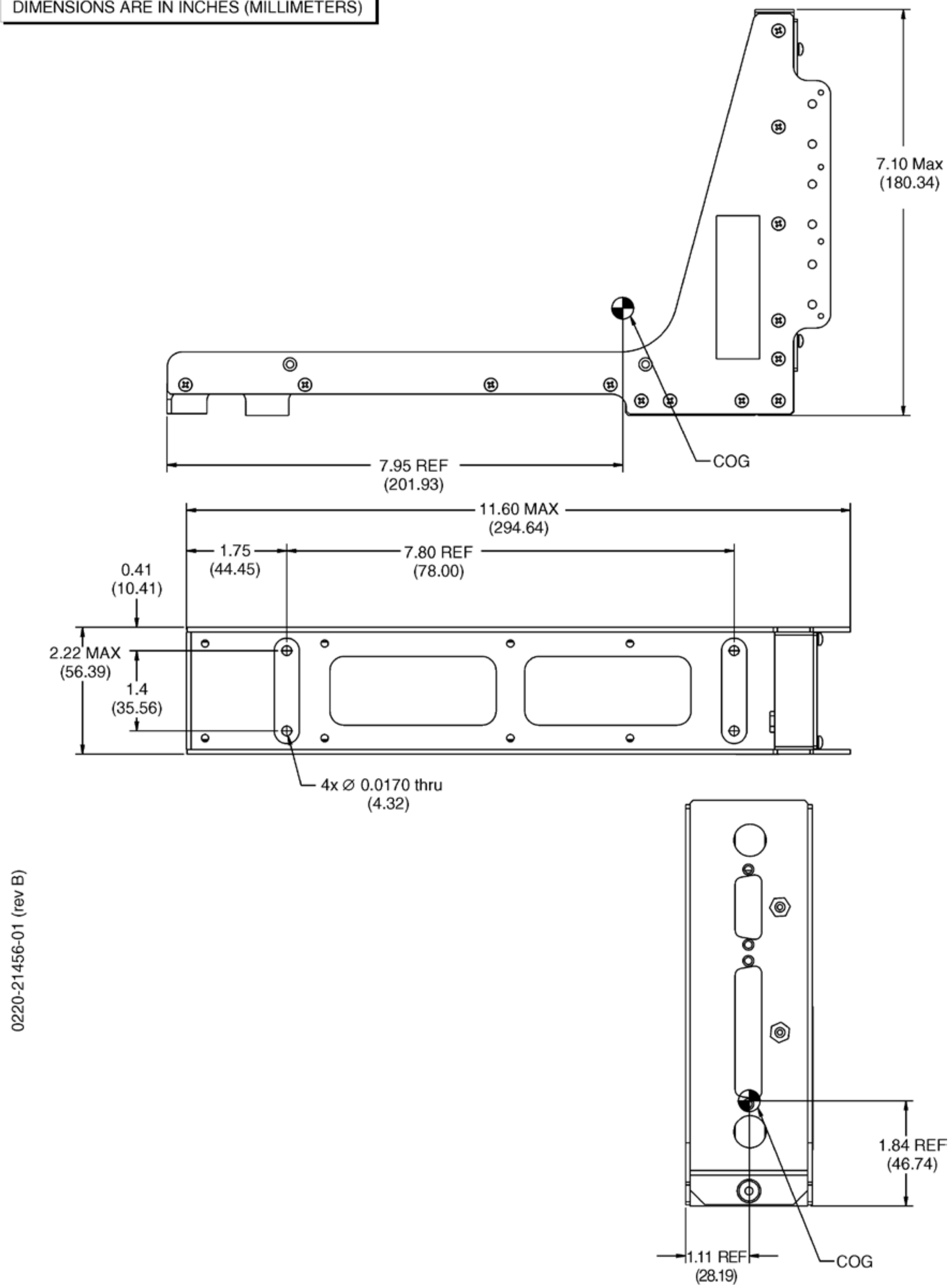
A. GDR-XXXX

NOTE: DIMENSIONS ARE IN INCHES [MILLIMETERS]



B. GDR TRAY

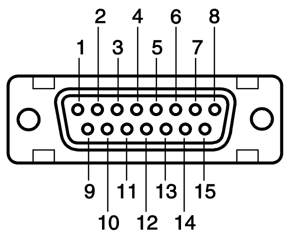
NOTE
DIMENSIONS ARE IN INCHES (MILLIMETERS)



21. GDR-XXXX CONNECTOR DRAWINGS

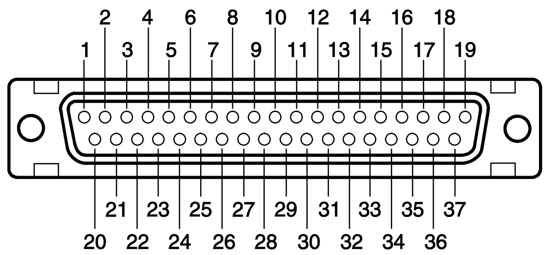
All connector drawings are shown viewed from the mating face of the connector.

A. P1 Connector



Pin	Description	Pin	Description
1	A/C POWER (28VDC)	9	GROUND
2	SIDETONE+	10	UHF MIC+
3	SIDETONE-	11	UHF MIC-
4	VHF PTT	12	UHF PTT
5	UHF AUDIO-	13	VHF AUDIO-
6	UHF AUDIO+	14	VHF AUDIO+
7	VHF MIC-	15	TX INTERLOCK
8	VHF MIC+		

B. P2 Connector



Pin	Description	Pin	Description
1	A/C POWER (28VDC)	20	NAV AUDIO-
2	GROUND	21	ARINC 429 TX A
3	RS-232 GND	22	ARINC 429 TX B
4	RS-232 RX1	23	NAV AUDIO+
5	RS-232 TX1	24	MB AUDIO+
6	RESERVED	25	MB AUDIO-
7	SDI1	26	RS-232 RX2
8	SDI2	27	RESERVED
9	RESERVED	28	RESERVED
10	RESERVED	29	GND
11	RESERVED	30	RESERVED
12	RESERVED	31	RESERVED
13	RESERVED	32	RESERVED
14	RESERVED	33	ILS ENERGIZE
15	RX1 A (ARINC 429)	34	RS-232 TX2
16	RX1 B (ARINC 429)	35	PS ENABLE
17	RX2 A (ARINC 429)	36	EMERGENCY
18	RX2 B (ARINC 429)	37	GND
19	RESERVED		

22. WIRING DIAGRAMS

This section will provide generic diagrams for installation of auxiliary equipment to the GDR-XXXX. Refer to the aircraft wiring diagrams for actual connections.

NOTE: Wiring codes in the diagrams are for reference and may not reflect the actual wire codes on the aircraft. Refer to the aircraft installation drawings for correct codes and connections.

WIRING NOTES:

1. Unless noted otherwise, all new wire to meet MIL-W-22759/16 or later revision. All shielded wire to be MIL-C-27500E with shields type (T) and jackets type (14). For additional routing, bonding, and grounding details, reference AC43-13-1B Chapter 11, Sections 9, 10, 11, and 15 or the airframe manufacturers Maintenance Manual.

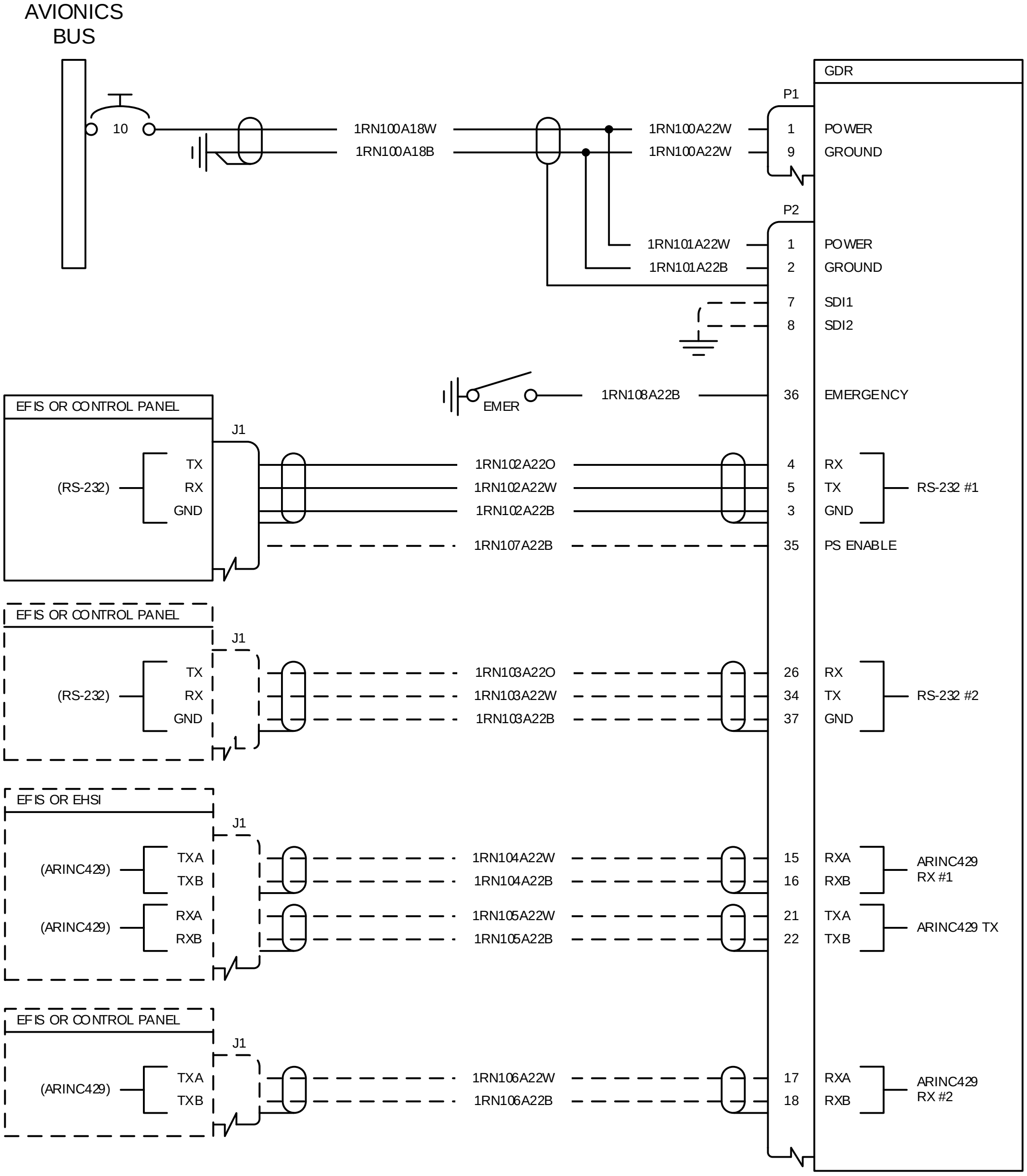
2. Grounds to be as short as possible unless otherwise indicated. Grounds under 6 inches in length do not require a wire number. Shield preparation should not exceed 3 inches from connector. Shield grounds may not be accomplished by daisy-chaining. Splicing or individually grounding shields to appropriate ground devices.

3. All wires 22AWG unless otherwise specified.

4. Small parts and electrical components required for installation that are not specifically called out in the parts lists shall meet the requirement for aerospace use as “Accepted Parts” or “Standard Parts”. Selection of these parts shall be in accordance with guidance provided in FAA Advisory Circular AC20-62D, Dated 5/24/96 or later revision.

5. Due to the many different configuration possibilities and options, the drawings are divided into function groups (Power, Communications, etc.) to allow flexibility in the installation.

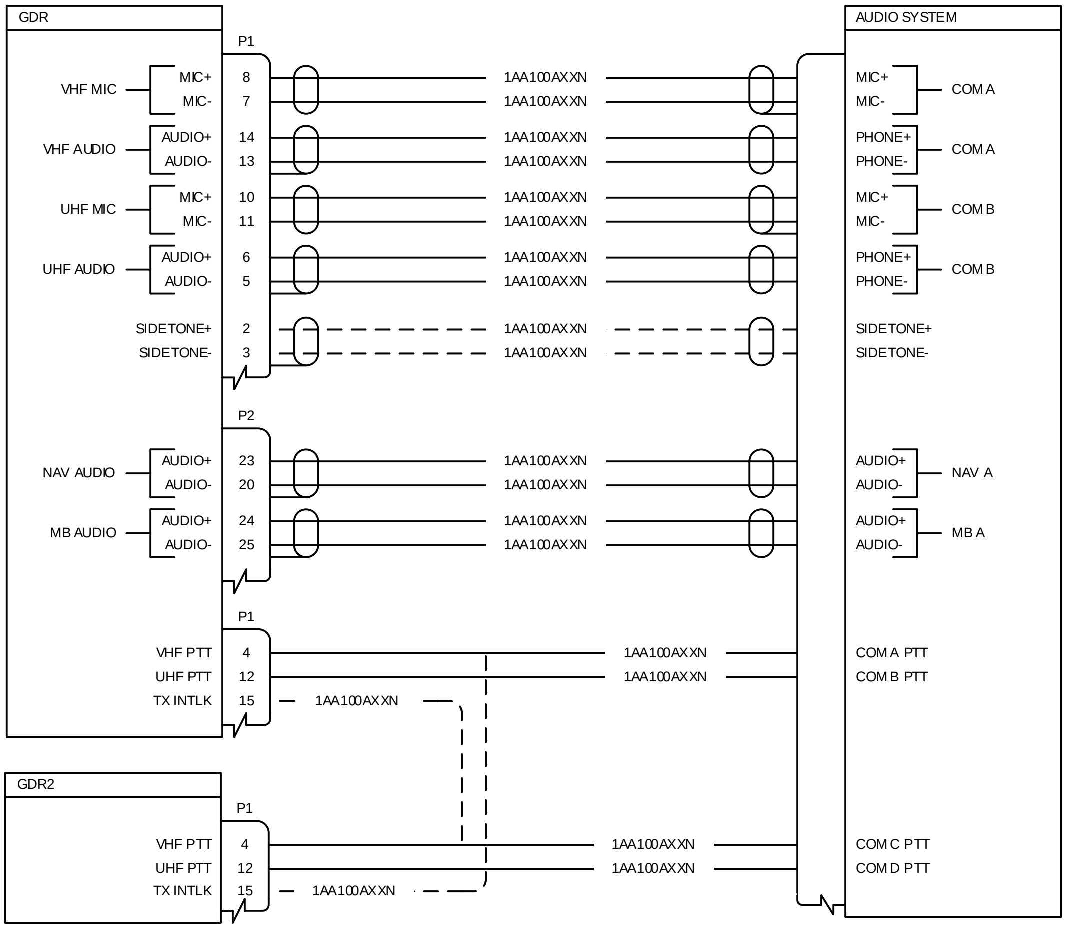
GDR POWER, DISCRETE, SERIAL BUS



NOTES:

1. SEPARATE POWER AND GROUND WIRES NO MORE THAN 12 INCHES FROM CIRCUIT BREAKER.
2. WIRE SDI PIN(S) TO AIRFRAME GROUND. REFER TO CHAPTER 2, SECTION 6.J FOR DETAILS
3. WIRE PS ENABLE TO CONTROL PANEL ON/OFF SWITCH OR DIRECT TO GROUND AS NEEDED.
4. EMERGENCY PIN WILL TUNE VHF AND UHF TRANSCEIVERS TO EMERGENCY FREQUENCY WHEN GROUNDED.
5. RS-232 AND ARINC429 INTERFACE WILL BE DETERMINED BY INSTALLER.

AUDIO



NOTES:
1. SHIELDS ARE GROUND TO CONNECTOR BACKSHELLS AT TRANMISSION END ONLY.
2. SIDETONE OUTPUT (P1 PINS 2 AND 3) IS OPTIONAL.
3. TX INTLK IS USED WHEN MULTIPLE RADIOS ARE LOCATED NEAR EACH OTHER AND UNINTENDED SQUELCH IS OPENED DUE TO THE OTHER RADIO. THE EXAMPLE ABOVE IS FOR VHF COMMUNICATION. TX INTLK MAY BE USED FOR UHF COMMUNICATIONS AS NEEDED.

CHAPTER 4 – GROUND FUNCTIONAL TESTS

This section provided the initial installation and return to service tests of the GDR.

		PASS	FAIL
1.0	**PURPOSE OF TEST:**		
1.1	The procedures defined in this plan will demonstrate the proper installation of the GDR-XXXX as installed on _______ aircraft.		
2.0	**TEST EQUIPMENT REQUIRED:**		
2.1	Digital Multi-Meter (DMM) Milliohm Meter Aeroflex IFR-4000 or equivalent NAV/COM Test Set		
3.0	**PRE-OPERATIONAL TESTS:**		
3.1	Structural test of the GDR NAV/COM1 mounting shelf with tray installed per Chapter 2, Section 4.	_____	_____
3.2	If installed, structural test of the GDR NAV/COM2 mounting shelf with tray installed per Chapter 2, Section 4.	_____	_____
3.3	Using a Milliohm Meter, verify the resistance between the NAV/COM1 tray assembly and structure is less than 2.5 milliohms.	_____	_____
3.4	If installed, use a Milliohm Meter and verify the resistance between the NAV/COM2 tray assembly and structure is less than 2.5 milliohms.	_____	_____
3.4	Using a Milliohm Meter, verify the resistance between the NAV/COM1 transceiver and the tray assembly when installed is less than 2.5 milliohms.	_____	_____
3.5	If installed, use a Milliohm Meter and verify the resistance between the NAV/COM2 transceiver and the tray assembly when installed is less than 2.5 milliohms.	_____	_____
3.6	Using a DMM, verify +28VDC on P1, Pin 1 and P2, Pin 1 for all GDRs installed in the aircraft.	_____	_____
3.7	Using a DMM, verify aircraft ground on P1, Pin 9 and P2, Pin 2 for all GDRs installed in the aircraft.	_____	_____
3.8	Using a DMM, verify continuity of all audio wiring between each GDR and the aircraft audio system. Verify there are no shorts between signal wires and shields or airframe ground.	_____	_____

		PASS	FAIL
3.9	Using a DMM, verify continuity of all control wiring between each GDR and the radio controllers or EFIS. Verify there are no shorts between signal wires and shields or airframe ground.	_____	_____
3.10	Using a DMM, verify continuity of center conductors of RF connectors and antennas. Verify continuity of shields to RF connectors. Verify there are no shorts between center conductors and shields.	_____	_____

4.0 OPERATIONAL / CONTINUED AIRWORTHINESS TESTS:

4.1 While transmitting, determined if the TX carrier is within 1 ppm of the transmit frequency. Adjust the 48 MHz reference standard as required.

CHAPTER 5 – TROUBLESHOOTING

This section provides guidance on troubleshooting the GDR-XXXX system. Refer to Chapter 4 for functional test procedures.

23. TOOLS

The following tools are required to test the GDR:

Aeroflex IFR-4000 or equivalent NAV/COM Test Set

24. SETUP

25. FAULT INDICATIONS

26. FAILURES

The table provided in this section may be used to assist in troubleshooting the GDR-XXXX and connected sensors. Always verify that the sensors connected to the GDR-XXXX are operating per the manufacturer's specification.

CONDITION	ACTION	CORRECTION

27. COM PORT INSPECTOR

28. GDR-XXXX MAINTENANCE UTILITY

APPENDIX A – ARINC 429 SPECIFICATIONS

The ARINC bus may contain concentrated commands for multiple sets of equipment. The LRU masks labels that it is not configured to receive. In addition to the label, the LRU uses the SDI bits to differentiate messages, e.g., up to three VHF COM receivers may be placed on the same bus and the target COM is determined by the strapped SDI bits as noted below. If a label is received by the unit, it is also retransmitted. Some labels are only transmitted from the LRU, which contain status or data.

Multiple bus inputs are handled in the order received with the last bus input determining the outcome, i.e., there is no priority bus. RS-232 and ARINC commands are handled together in this manner. ARINC shall be implement to allow bust mode turning, i.e., there is not a requirement for the normal label transmission rate on the input.

29. ARINC Labels 030 and 047, VHF COM

Labels 030 or 047 determine the frequency of the VHF COM and both labels are accepted by the radio. Only the label received by the radio shall be retransmitted, e.g., if radio 030 is received by the LRU, it will be transmitted without label 047 and vice versa. Label 030 shall be used for 25 kHz channels, while 047 shall be used for 8.33 kHz spaced channels. Both labels contain the channel name rather than frequency as per channel labeling scheme in ARINC 716, which is listed in Appendix A for reference.

The example shown below is for channel 118.000, which also has a frequency of 118.000 MHz and sets the receive bandwidth required for reception of a 25 kHz channel. Channel 118.005, has a frequency of 118.000 MHz and sets the receive bandwidth required for reception of an 8.33 kHz channel.

Table 12: VHF COM 118 MHz Frequency with 25 kHz or 8.33 kHz channel bandwidth

Function	Label	Parity (odd)	Sign/Status Matrix	10 MHz (1)	1 MHz (8)	0.1 MHz (0)	0.01 MHz (0)	0.001 MHz (0)	Res (SDI)	LABEL VHF COM FREQ. Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #		32	31 30	29 28 27	26 25 24 23	22 21 20 19	18 17 16 15	14 13 12 11	10 9	8 7 6	5 4 3	2 1
25 kHz	030	0	0 0	0 0 1	1 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 1	0 0 0	1 1 0	0 0
8.33 kHz	047	0	0 0	0 0 1	1 0 0 0	0 0 0 0	0 0 0 0	0 1 0 1	0 1	1 1 1	0 0 1	0 0

Table 13: Sign Status Matrix definition and SDI bit definition

Bit 31	Bit 30	Status
0	0	Squelch Normal
0	1	No Computed Data
1	0	Functional Test
1	1	Squelch Open

SDI Bits 10 9	Radio Number
0 0	All Call
0 1	COM 1
1 0	COM 2
1 1	COM 3

Notes: 1. The SSM matrix defines a bit configuration binary 10 for “Functional Test”, which shall initiate any COM IBIT, unless the NAV receiver is in the ILS mode.

2. A received SSM of 11 opens the receiver’s squelch. A SSM returned from the unit indicates the squelch is opened by either a received signal or the RMU. This can be used as a means to indicate channel activity.

3. The LRU shall use the SSM matrix of labels 030 and 047 to annunciate any corrupt or invalid data associated with the label by setting the SSM to NCD on the retransmitted word. LRU failures are reported on label 350.

4. The channel number’s hundreds place both have a default value of “1”, i.e., they have 100 MHz added to the sent number.

30. ARINC Label 034, VOR/ILS Frequency

Label 034 is used for tuning the VOR or ILS frequency.

Table 14: NAV Frequency Selection Format for 109.3 MHz, ARINC Label 034

	Parity (odd)	Sign/Status Matrix	10 MHz (0)	1 MHz (9)	0.1 MHz (3)	0.02 MHz (0)	See Table Below	Res (SDI)	VHF NAV FREQ. Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28 27	26 25 24 23	22 21 20 19	18 17 6 15	14 13 12 11	10 9	8 7 6	5 4 3	2 1
109.3 MHz	0	0 0	0 0 0	1 0 0 1	0 0 1 1	0 0 0 0	0 0 0 0	0 0	0 0 1	1 1 0	0 0
									4	3	0

Note: 1) The frequency transmitted has an implied 100 MHz added.

2) Bit 14 is used is systems where the DME is tuned by the VOR/ILS and acts as a hold function. When set to a ‘1’ the DME is held at the last frequency tuned with a ‘0’ value.

Table 15: Definition of Bits 11 to 13 for Label 034

Bit Number	Description	
Bit 11	Marker Sensitivity	‘1’ denotes high, “0” denotes low
Bit 12	VOR Rotor Filtering	‘1‘ denotes employed. “0” denotes no filter
Bit 13	Reserved	
Bit 14	DME Hold	‘1’ denotes the DME is held at the last channel

Table 16: Sign Status Matrix definition

31	30	Status
0	0	Verified
0	1	No Computed Data
1	0	Functional Test
1	1	Not Defined

Table 17: ARINC SDI bit definition

SDI Bits 10 9	J100 Pin 15	J100 Pin 44	Radio Number
0 0	Gnd	Gnd	All Call
0 1	Gnd	Open	NAV 1
1 0	Open	Gnd	NAV 2
1 1	Open	Open	NAV 3

31. ARINC Label 035, DME Frequency

Label 035 is generated by the NAV radio to tune a companion DME if desired.

Table 18: DME Frequency Format for 109.3 MHz, ARINC Label 035

	Parity (odd)	Sign/Status Matrix	10 MHz (0)	1 MHz (9)	0.1 MHz (3)	0.00/0.05 MHz	Ident Display	MLS Freq.	ILS Freq.	DME Mode	Res (SDI)	DME Tune Octal LSB 1 2 4	 1 2 4	 MSB 1 2
Bit #	32	31 30	29 28 27	26 25 24 23	22 21 20 19	18	17 16	15	14	13 12 11	10 9	8 7 6	5 4 3	2 1
109.3 MHz	0	0 0	0 0 0	1 0 0 1	0 0 1 1	0	0 0	0	0	0 0 0	0 0	1 0 1	1 1 0	0 0
												5	3	0

Note: 1) The frequency in this label is the frequency to which the NAV radio is tuned plus 100 MHz.
2) The DME does the translation to the required DME frequency.
3) The SDI bits of the NAV radio are used to determine the DME number as shown in Table 22 .
4) The SDI bits for Label 035 should always be set to “All Call”, if a scanning DME is used.
5) The Sign Status Matrix is always set to Verified.
5) Table 21 defines the bit definitions for the navigational source, which will be set to ILS or VOR mode as determined by the NAV frequency received.

Table 19: ARINC Label 035, Bits 11-13

Bit 13	Bit 12	Bit 11	Function	NAV SDI
0	0	0	Standby	
0	0	1	DME #1 Frequency	NAV 1
0	1	0	DME #2 Frequency	NAV 2
0	1	1	DME #3 Frequency	NAV 3
1	0	0	DME #4 Frequency	
1	0	1	DME #5 Frequency	
1	1	0	Free Scan	
1	1	1	Spare	

Table 20: Sign Status Matrix definition

Bit 31	Bit 30	Status
0	0	Verified
0	1	No Computed Data
1	0	Functional Test
1	1	Not Defined

Table 21: Navigation source bit definition

Bit 15	Bit 14	Definition
0	0	VOR Freq. Tuned
0	1	ILS Freq. Tuned
1	0	MLS Enabled
1	1	Spare

Table 22: ARINC Label 035 SDI bit definition

SDI Bits 10 9	Radio Number
0 0	All Call
0 1	DME 1
1 0	DME 2
1 1	DME 3

32. ARINC Label 040, UHF COM

Label 040 is used to control the UHF COM transceiver. UHF operation covers the band of 225 to 399.975 MHz. Operations can be simplex or semi-duplex operation when a repeater is utilized. In semi-duplex operation, the transmission frequency is different from the received frequency.

When the semi-duplex mode is chosen, two label pairs shall be sent, back to back, with the proper encoding to provide both the Main transmit and receive frequency information. In simplex mode, the transmit frequency shall default to the Main receive frequency; therefore, the second label is not required.

Table 23: UHF COM Data Format Label 040

Function	Parity (odd)	Sign/Status Matrix	100 MHz (3)	10 MHz (3)	1 MHz (8)	0.1 MHz (0)	12.5 kHz (12.5)	Simplex Word Bit 2 Word Bit 1	Res (SDI)	LABEL UHF COM FREQ. Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29	28 27 26 25	24 23 22 21	20 19 18 17	16 15 14	13 12 11	10 9	8 7 6	5 4 3	2 1
338.0125 MHz	1	0 0	1	0 0 1 1	1 0 0 0	0 0 0 0	0 0 1	1 0 0	0 1	0 0 0	0 0 1	0 0
										0	4	0

Table 24: Modulation Bits

12	11	Function
0	0	AM modulation
0	1	FM, wideband modulation
1	0	FM, narrowband modulation
1	1	TX frequency encoded

Table 25: Bit 13

Bit Position	Description
Bit 13	0 = Semi-duplex. 1 = Simplex

Table 26: SDI bit definition

SDI Bits 10 9	Radio Number
0 0	All Call
0 1	COM 1
1 0	COM 2
1 1	COM 3

Table 27: Sign Status Matrix definition

31	30	Status
0	0	Squelch Normal
0	1	No Computed Data
1	0	Functional Test
1	1	Receiver Squelch Open

Notes:

1. The 100 MHz position has an implied 200 MHz added.
2. The 12.5 kHz position uses the binary value multiplied by 12.5 kHz. This allows either 25 kHz or 12.5 kHz spaced channels as desired.
3. The LRU shall use the SSM matrix of label 040 to annunciate received corrupt or invalid data by NCD.
4. The SSM matrix defines the bit configuration 10 for “Functional Test”, which shall initiate any COM IBIT, unless the NAV is in the ILS mode.
5. A received SSM of 11 shall open the receiver’s squelch gate.

6. A SSM transmitted from the LRU shall indicate when the squelch is opened by either channel activity or the received SSM. This can be used as a means to display channel activity to the pilot when desired. The LRU shall transmit label 040 immediately upon a state change to reduce latency for this function but no more frequently than allowed by the 040 label transmission rate.

33. ARINC Label 173, LOC Deviation

The calculated ddm of the Localizer is transmitted on ARINC label 173. When valid data is not present, the SSM is set to “No Computed Data”.

Table 28: LOC Deviation Specification, ARINC Label 173

Label	PARAMETER NAME	UNITS	RANGE	SIG. BITS	APPROX. RESOLUTION
173	Localizer Deviation	DDM	± 0.4	12	0.0001

Table 29: LOC Deviation Format, ARINC Label 173

	Parity (odd)	Sign/Status Matrix	DATA FIELD MSB … LSB	Res (SDI)	LOC Deviation Octal LSB 1 2 4	 1 2 4	 MSB 1 2
Bit #	32	31 30	29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
+0.021 DDM	1	1 1	0 0 0 0 0 1 1 0 1 1 0 0 0 P P P P P P	0 0	1 1 0	1 1 1	1 0
					3	7	1

Note: 1) “P” denotes a pad with a “0” value.

2) Negative values are encoded as the two’s complements of positive values and the negative sign is annunciated in bit 29.

3) The transmitted binary value is found as (ddm)/0.4 * 4096, encoded as two’s complement.

4) The two's complement of an N-bit number is the result of subtracting the number from 2^N.

Table 30: Status Matrix definition

Bit 31	Bit 30	Status
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Functional

Table 31: Sign Bit definition

Bit 29	Meaning
0	Right
1	Left

34. ARINC Label 174, G/S Deviation

The calculated ddm of the Glideslope is transmitted on ARINC label 174. When valid data is not present, the SSM is set to “No Computed Data”.

Table 32: Glideslope Deviation Specification, ARINC Label 174

Label	PARAMETER NAME	UNITS	RANGE	SIG. BITS	APPROX. RESOLUTION
174	Glideslope Deviation	DDM	± 0.8	12	0.0002

Table 33: Glideslope Deviation Format, ARINC Label 174

	Parity (odd)	Sign/Status Matrix	DATA FIELD MSB … LSB	Res (SDI)	G/S Deviation Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
-0.125 DDM	0	1 1	1 1 1 0 1 1 0 0 0 0 0 0 0 P P P P P P	0 0	0 0 1	1 1 1	1 0
					4	7	1

Note:
1) “P” denotes a pad with a “0” value.
2) Negative values are encoded as the two’s complements of positive values and the negative sign is annunciated in bit 29.
3) The transmitted binary value is found as ddm/0.8 * 4096, encoded as two’s complement.
4) The two's complement of an N-bit number is the result of subtracting the number from 2^N.

Table 34: Status Matrix definition

Bit 31	Bit 30	Status
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Functional

Table 35: Sign Bit definition

Bit 29	Meaning
0	Above
1	Below

35. ARINC Label 222, VOR Bearing and Marker Beacon Tones

The calculated VOR Bearing is transmitted on ARINC label 222. When valid data is not present, the SSM bits are set for no computed data.

Table 36: VOR Bearing Specification, ARINC Label 222

Label	PARAMETER NAME	UNITS	RANGE	SIG. BITS	APPROX. RESOLUTION
222	VOR Omni-bearing	$\frac{\text{Degrees}}{180}$	±180˚	12	0.044˚

Table 37: VOR Bearing Format, ARINC Label 222

	Parity (odd)	Sign/Status Matrix	DATA FIELD MSB … LSB	Spares (Pads)	ILS	Marker Beacon Tones	Res (SDI)	VOR Bearing Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28 27 26 25 24 23 22 21 20 19 18 17	16 15	14	13 12 11	10 9	8 7 6	5 4 3	2 1
LABEL 222	0	0 0	0 0 0 0 0 0 0 0 0 0 0 0 0	P P	0	0 0 0	0 0	0 1 0	0 1 0	0 1
								2	2	2

Note: (1) 'P' denotes a pad set for a '0' value.
(2) Negative values are encoded as the two's complements of positive values and the negative sign is annunciated in the sign/status matrix.
(3) Angles in the range 0 to 180˚are encoded as positive numbers. Angles in the range >180˚ to <360˚ are subtracted from 360˚ and the resulting number encoded as a negative value per note 2.
(4) Bits 11 to 13 are set as per Table 40 when valid Marker Beacon Tones are present. The presence of these tones does not affect the SSM matrix. Only one tone is allowed to be present and shall have a dominance of > 20 dB over the other tones.
(5) Bit 14 designates ILS mode and indicates only the Marker Tones are functional and the Data field is parked at all zeros.

Table 38: Status Matrix definition

Bit 31	Bit 30	Status
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Functional

Table 39: Sign Bit definition

Bit 29	Meaning
0	Plus
1	Minus

Table 40: Marker Beacon Tone Bit definition

Discrete	Bit	Bit State Tone Dominate	 No Tone
400 Hz	11	1	0
1,300 Hz	12	1	0
3,000 Hz	13	1	0

36. ARINC Label 242 & 244, VOR Ground Station ID

The detected VOR Station Morse code is transmitted on ARINC labels 242 and 243. When valid data is not present, the SSM bits are set for no computed data.

Table 41: Morse code first word format, ARINC Label 263

	Parity (odd)	Sign/Status Matrix	Spare	Spare	P	2nd Character (A) MSB LSB	P	1st Character (V) MSB LSB	Res (SDI)	Character ID Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28	27	26	25 24 23 22 21 20 19	18	17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
LABEL 242	0	1 1	0 0	0	0	1 0 0 0 0 0 1	0	1 0 1 0 1 1 0	0 0	0 1 0	0 0 1	0 1
						ASCII (65)		ASCII (86)		2	4	2

Table 42: Morse code second word format, ARINC Label 264

	Parity (odd)	Sign/Status Matrix	Spare	Spare	P	4th Character (C) MSB LSB	P	3rd Character (B) MSB LSB	Res (SDI)	Character ID Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28	27	26	25 24 23 22 21 20 19	18	17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
LABEL 244	0	1 1	0 0	0	0	1 0 0 0 0 1 1	0	1 0 0 1 0 1 0	0 0	0 0 1	0 0 1	0 1
						ASCII (67)		ASCII (66)		4	4	2

Table 43: Status Matrix definition

Bit 31	Bit 30	Status
0	0	Verified
0	1	No Computed Data
1	0	Functional Test
1	1	Not Defined

37. ARINC Label 263 & 264, ILS Ground Station ID

The detected Morse code is transmitted on ARINC labels 263 and 264. When valid data is not present, the SSM bits are set for “No Computed Data”.

Table 44: Morse code first word format, ARINC Label 263

	Parity (odd)	Sign/Status Matrix	Spare	Act/Standby	P	2nd Character (A) MSB … LSB	P	1st Character (I) MSB … LSB	Res (SDI)	Character ID Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28	27	26	25 24 23 22 21 20 19	18	17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
LABEL 263	0	1 1	0 0	0	0	1 0 0 0 0 0 1	0	1 0 0 1 0 0 1	0 0	1 1 0	0 1 1	0 1
						ASCII (65)		ASCII (73)		3	6	2

Table 45: Morse code second word format, ARINC Label 264

	Parity (odd)	Sign/Status Matrix	Spare	Act/ Standby	P	4th Character (C) MSB … LSB	P	3rd Character (B) MSB … LSB	Res (SDI)	Character ID Octal LSB 1 2 4	1 2 4	MSB 1 2
Bit #	32	31 30	29 28	27	26	25 24 23 22 21 20 19	18	17 16 15 14 13 12 11	10 9	8 7 6	5 4 3	2 1
LABEL 264	0	1 1	0 0	0	0	1 0 0 0 0 1 1	0	1 0 0 1 0 1 0	0 0	0 0 1	0 1 1	0 1
						ASCII (67)		ASCII (66)		4	6	2

Table 46: Status Matrix definition

Bit 31	Bit 30	Status
0	0	Verified
0	1	No Computed Data
1	0	Functional Test
1	1	Not Defined

Table 47: Sign Bit definition

Bit 27	Meaning
0	Active Receiver ID
1	Standby Receiver ID

38. ARINC Label 350 LRU Maintenance Status

The following word contains current BIT status of the radio.

Table 48: Maintenance Status

Function	Label	Parity (odd)	Sign Status Matrix	Maintenance Discrete Bits				Res (SDI)	LABEL Octal		
									LSB		MSB
Bit		32	31 30	29 28 27 26 25	24 23 22 21 20 19	18 17 16 15	14 13 12 11	10 9	8 7 6	5 4 3	2 1
Co. Info.	350	x	0 0	x x x x x	0 1 1 1 0 0	0 0 0 1	0 1 1 0	x x	0 0 0	1 0 1	1 1

Table 49: Label 350 maintenance bit definition

Bit	Function	Coding	Notes
1	Label	1	(msb) 3 decimal
2	Label	1	
3	Label	1	
4	Label	0	5 decimal
5	Label	1	
6	Label	0	
7	Label	0	0 decimal
8	Label	0	(lsb)
9	SDI	(lsb)	00 Not used 01 LRU #1
10	SDI	(msb)	10 LRU#2 11 LRU #3
11	GlideSlope PLL unlocked	B1	Set high if the GS LO has a failure
12	NAV PLL unlocked	B2	Set high if the NAV LO has a failure
13	VHF COM PLL unlocked	B3	Set high if the VHF PLL has a failure
14	UHF COM PLL unlocked	B4	Set high if the UHF PLL has a failure
15	Guard PLL unlocked	B5	Set high if the Guard PLL has a failure
16	Transmitter LO Power	B6	Set high if the TX power is low
17	HI COM VSWR	B7	Set high an antenna failure is detected
18	Mic Stuck	B8	Set high if Mic timeout has occurred
19	A/C voltage low	B9	Set high if input voltage is low
20	Temperature high	B10	Unit exceeds temperature high
21	Temperature low	B11	Unit exceeds temperature low
22	Internal voltage error	B12	Internal power supply failure
23	PBIT failure	B13	Unit failed power on test
24	TBD	B14	To be defined
25	TBD	B15	To be defined
26	TBD	B16	To be defined
27	TBD	B17	To be defined
28	TBD	B18	To be defined
29	TBD	B19	To be defined
30	SSM	(lsb)	00 Normal; 01 Standby
31	SSM	(msb)	10 Functional Test; 11 Failure Warn
32	Parity	ODD	

Table 50: Status Matrix definition

Bit 31	Bit 30	Status
0	0	Verified
0	1	No Computed Data
1	0	Functional Test
1	1	Not Defined

39. ARINC 429 Update Rate (ARINC 429-18, Attachment 2)

Label	Transmit Interval Min. (mSec)	Transmit Max. (mSec)
030	100	200
034	100	200
035	100	200
040	100	200
047	100	200
173	33.3	62.5
174	33.3	62.5
222	50	100
242	100	200
244	100	200
263	100	200
264	100	200
350	500	1000