**BendixKing**

# System Installation Manual

# KGX 150/130 Transceivers and Receivers

| Part Number | CAGE |
|---|---|
| 89000016-130 | 6PC31 |
| 89000016-131 | 6PC31 |
| 89000016-150 | 6PC31 |
| 89000016-151 | 6PC31 |

**Legal Notice**

**Export Control**

Initial 19 Jan 2015
Revised 22 Dec 2016

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# TRANSMITTAL INFORMATION

REVISION NUMBER 1 DATED 22 DEC 2016

TO HOLDERS OF KGX 150/130 TRANSCEIVERS AND RECEIVERS SIM PUB. NO. D201405000059 ISSUED FOR USE IN SUPPORT OF THE FOLLOWING:

Table TI-1 shows the applicable components.

**Table TI-1.  Applicable Components**

| Component PN | Nomenclature |
|---|---|
| 89000016-130 | KGX 130T ADS-B Transceiver without Internal GPS |
| 89000016-131 | KGX 130R ADS-B Receiver without Internal GPS |
| 89000016-150 | KGX 150R ADS-B Receiver with Internal WAAS GPS |
| 89000016-151 | KGX 150T ADS-B Transceiver with Internal WAAS GPS |

## Revision History

Table TI-2 shows the revision history of this SIM.

**Table TI-2.  Revision History**

| Revision Number | Revision Date |
|---|---|
| 0 | 19 Jan 2015 |
| 1 | 22 Dec 2016 |

This revision is a full replacement.  All pages have a new date, as identified in the List of Effective Pages. Revision bars identify the changed data.  See Transmittal information for history of revisions to this SIM.

Remove and discard all pages of the manual and replace them with the attached pages.  Write the revision number, revision date, and replacement date on the Record of Revisions page.

The table of highlights tells users what has changed as a result of the revision.  The table consists of three columns.

The Task/Page column identifies the blocks of changed information, such as a task, subtask, graphic, or parts list, and the page on which that block starts.  The block of information often includes the MTOSS code.  Revision marks, when provided, identify the location of the change within the block.

The Description of Change column tells about the change or changes within each block.  The description of change is often preceded by a paragraph or figure reference that applies to the block of information.

The Effectivity column tells the user the part number(s) to which the block of information applies.  The default value for this column is "All."  "All" means that the block applies to all parts.

**Table of Highlights**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| SERVICE BULLETIN LIST | Added SB 89000016-34-0001 (D201603000071) in the service bulletin list. | All |

**Table of Highlights (Cont)**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| INTRODUCTION | Updated the content and format of the Introduction section to agree with Honeywell processes in effect at the time of the release of this revision. Rev bars not used. | All |
| Page INTRO-10 | Paragraph 4.B. Added Service Information Documents. | All |
| Page INTRO-10 | Paragraph 4.B. Added SIL D201608000055 to Table INTRO-2. | All |
| Page 1 | Paragraph 1.A. Added WITHOUT INTERNAL GPS to the KTG 130 series components in Table 1. | All |
| Page 1 | Paragraph 2.A. Added TSO/MOPS data in Step (1). Updated the text in Steps (3) and (4). | All |
| Page 2 | Figure 1. Updated graphics to include the latest data. | All |
| Page 2 | Figure 2. Updated graphics to include the latest data. | All |
| Page 4 | Paragraph 2.B. Updated the text in Step (2). | All |
| Page 5 | Paragraph 2.C. Changed TSO-C88a to TSO-C88b and added ETSO-C88a in Step (1). | All |
| Page 5 | Paragraph 2.C. Added a note in Step (4). Updated the nomenclature in Step (5). | All |
| Page 7 | Paragraph 2.E. Updated the text in Step (2). | All |
| Page 7 | Paragraph 3.A. Updated the TSO specification in Table 2. Updated the discrete and GPS descriptions in Table 3. Updated the width and depth in Table 4. | All |
| Page 1001 | Paragraph 1.A. Added a new last sentence in Step (3). | All |
| Page 1001 | Paragraph 3.A. Updated KGX descriptions in Table 1001. | All |
| Page 1004 | Paragraph 4.A. Added new Garmin and BendixKing part numbers and changed the model number for the Garmin manufacturer in Table 1007. | All |
| Page 1004 | Paragraph 5. Added FT-9000 RAMP Tester data. | All |
| Page 1009 | Paragraph 9.A. Updated Table 1010 and added Table 1010 footnote. | All |

**Table of Highlights (Cont)**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| Page 1011 | Paragraph 10.B. Changed I/O for J1-43 from I to O in Table 1012. | All |
| Page 1013 | Paragraph 10.E. Added RS-232 and note to serial Port 6 data in Step (2) and in Table 1015. | All |
| Page 1015 | Paragraph 10.F. Updated the text and added a note in Step (1). Added anonymous mode data in Table 1017. Updated the text in Step (2). Added Step (4). | All |
| Page 1015 | Paragraph 10.F. Step (2)(b) was deleted by this revision. No revision bar. | All |
| Page 1017 | Paragraph 10.I. Updated Step (1) and Table 1019. | All |
| Page 1017 | Paragraph 10.J. Updated Steps (1) and (2). Added Steps (4) thru (6). The subsequent steps are renumbered. Added Figure 1005. Changed the title of Table 1020 from RS-232 Connections to MPI Pinout. Updated the text in Steps (8) and (9) and the note associated with Step (9). | All |
| Page 1019 | Paragraph 12.D. Added a reference to the Serial Interface Specifications section in Step (1). | All |
| Page 1021 | Paragraph 14.A. Updated Step (1). | All |
| Page 1022 | Paragraph 14.B. Updated Step (2). | All |
| Page 1022 | Paragraph 14.C. Changed 2.5 to 5.5 in Step (2). | All |
| Page 1024 | Paragraph 15.D. Changed SBAS to WAAS in Step (1). Changed Section 4B to Section 14-1 in Step (2). | All |
| Page 1025 | Paragraph 17.A. Text from E.(1) was added as new Step (1). No revision bar. | All |
| Page 1025 | Paragraph 17.A. Added a note to Step (3). | All |
| Page 1025 | Paragraph 17.B. Updated the text in Step (1). | All |
| Page 1025 | Paragraph 17.C. Updated the text in Step (1). | All |
| Page 1026 | Paragraph 17.D. Updated the text in Step (1). | All |
| Page 1026 | Paragraph 17.F. Added a non-TSO functions statement. | All |

**Table of Highlights (Cont)**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| Page 2001 | Paragraph 1. Replaced Paragraphs 1 thru 10 with new Paragraphs 1 thru 6. The subsequent paragraphs are renumbered. Replaced Figures 2001 thru 2008. Added Figures 2009 thru 2012 and applicable text and tables. | All |
| Page 3001 | Paragraph 1.A. Added Step (2) and Pub. No. D201405000060. | All |
| Page 3001 | Paragraph 1.C. Added a description of the control panel buttons and knobs and a reference to the applicable pilot's guide in Step (1). Added new Figure 3002 thru Figure 3004 and applicable text data in Step (2). Deleted old Steps (3) thru (6) and Tables 3001 thru 3003. The subsequent steps, tables, and figures are renumbered. Updated Step (3). | All |
| Page 3003 | Figure 3002. Added KGX Control Panel Wave Symbols graphic. | All |
| Page 3003 | Figure 3003. Added Display in ALT mode graphic. | All |
| Page 3003 | Figure 3004. Added Reverse Video Examples when KGX Control Panel is in External Control Mode. | All |
| Page 3004 | Paragraph 2.A. Updated Step (4). Deleted Steps (5) and (6). The subsequent steps are renumbered. | All |
| Page 3004 | Paragraph 3.A. Added the word typical to the text in Step (1). | All |
| Page 3005 | Paragraph 3.B. Updated the serial Port 6 configuration in Table 3001. Updated the default in Table 3002. Added display data output and Footnote 3 in Table 3003. | All |
| Page 3007 | Paragraph 3.C. Updated Step (1). Updated Table 3004 thru Table 3007, Table 3009, Table 3011, and Table 3017. Added Table 3012 and Table 3020. The subsequent tables are renumbered. | All |
| Page 3007 | Paragraph 3.C. Added label 270 to Table 3019. | All |
| Page 3017 | Paragraph 4.A. Updated Step (5). | All |
| Page 3020 | Figure 3006. Added Tera Term Terminal Strip graphic. | All |
| Page 3020 | Figure 3007. Added Tera Term Serial Port Setup graphic. | All |

**Table of Highlights (Cont)**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| Page 3021 | Figure 3008. Added Tera Term WiFi Connection Settings Initial MPI Connection graphic. | All |
| Page 3021 | Figure 3009. Updated graphic to include the latest data. | All |
| Page 3022 | Paragraph 4.C. Changed the paragraph title to Terminal Maintenance Commands. Updated Table 3023. Deleted old Paragraph (7) and Figure 3012. Deleted old Paragraph (15) and Figure 3020. The subsequent paragraphs and figures are renumbered. Updated Step (9), Step (10). | All |
| Page 3022 | Paragraph 4.C. Globally changed "rx status" to "rxstatus" in the text. A revision bar is not used to show this change. | All |
| Page 3023 | Figure 3011. Updated graphic to include the latest data. | All |
| Page 3023 | Figure 3012. Updated graphic to include the latest data. | All |
| Page 3024 | Figure 3013. Updated graphic to include the latest data. | All |
| Page 3024 | Figure 3014. Updated graphic to include the latest data. | All |
| Page 3025 | Figure 3016. Updated graphic to include the latest data. | All |
| Page 3026 | Figure 3017. Updated graphic to include the latest data. | All |
| Page 3027 | Figure 3019. Updated graphic to include the latest data. | All |
| Page 3028 | Figure 3020. Updated graphic to include the latest data. | All |
| Page 3029 | Figure 3021. Updated graphic to include the latest data. | All |
| Page 3029 | Paragraph 4.D. Added a note in Step (3). | All |
| Page 3030 | Figure 3023. Updated graphic to include the latest data. | All |
| Page 3031 | Sheet 1 of Figure 3024. Updated graphic to include the latest data. | All |
| Page 3032 | Figure 3025. Updated graphic to include the latest data. | All |
| Page 3032 | Figure 3026. Updated graphic to include the latest data. | All |
| Page 3034 | Figure 3031. Updated graphic to include the latest data. | All |
| Page 3035 | Figure 3032. Updated graphic to include the latest data. | All |

**Table of Highlights (Cont)**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| Page 3035 | Figure 3034. Updated graphic to include the latest data. | All |
| Page 3036 | Figure 3035. Updated graphic to include the latest data. | All |
| Page 3036 | Figure 3036. Updated graphic to include the latest data. | All |
| Page 3037 | Figure 3037. Updated graphic to include the latest data. | All |
| Page 3038 | Paragraph 4.F. Updated Step (4) to add compatibility with the ADS-B system. | All |
| Page 3038 | Figure 3040. Updated graphic to include the latest data. | All |
| Page 3039 | Figure 3043. Added "set displayout" Command graphic. | All |
| Page 3040 | Paragraph 4.G. Added Subtask G, Tabie 3024. The subsequent tables and figures are renumbered. | All |
| Page 3040 | Figure 3044. Added "setpw" Command. | All |
| Page 3041 | Figure 3045. Added "checkpw" Command. | All |
| Page 3041 | Figure 3046. Added "resetpw" Command | All |
| Page 3041 | Figure 3047. Added "maint ascii pw" Command. | All |
| Page 3041 | Paragraph 5.A. Updated Step (1) and the note in Step (1). | All |
| Page 3042 | Paragraph 5.B. Updated Step (1)(a). | All |
| Page 3042 | Paragraph 5.C. Changed four serial channels to five serial channels in Step (7). | All |
| Page 3042 | Paragraph 5.C. Updated Step (8)(a). | All |
| Page 3042 | Paragraph 5.C. Updated Step (10)(a). | All |
| Page 3042 | Paragraph 5.C. Added Other 2 in Step (12)(a). Added GPS in Step (14). Added a note in Step (17)(b). Updated the text in Step (18)(d). Updated the text in Step (22). Added notes in Step (25)(a) and (c). | All |
| Page 3056 | Paragraph 6.B. Updated the section reference in Step (1)(a). Removed the third sentence in Step (3)(c). Updated Step (4)(b). | All |
| Page 4001 | Paragraph 2.B. Added KGX in Table 4002. | All |

**Table of Highlights (Cont)**

| Task/Page | Description of Change | Effectivity |
|---|---|---|
| Page 4002 | Paragraph 3.A. Added WARNING display data in Step (1). Updated Table 4003 and Table 4004. | All |
| Page 5002 | Paragraph 2.A. Table 5002: Changed altitude from 50,000 feet (15, 240 m) to 35,000 feet (10,668 m). Changed the low operating temperature from -40°F (-40°C) to -4°F (-20°C). | All |
| Page 6001 | Paragraph 3. Added the word Sensor to the task title. | All |
| Page 6001 | Paragraph 3.A. Added (default minimum) to the first bullet in Step (1). | All |
| Page 7001 | Paragraph 1.A. Changed No. 33 comments for item 33 from Installation configuration to from GPS data. | All |
| Page 8001 | Paragraph 1.C. Replaced Table 8001 with updated Step (1)(a). | All |
| Page 8001 | Figure 8001. Updated graphic to include the latest data. | All |
| Page 8002 | Paragraph 1.E. Added crimp pin to Table 8005. | All |
| Page 8009 | Figure 8007. Updated graphic to include the latest data. | All |

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# RECORD OF REVISIONS

For each revision, write the revision number, revision date, date put in the manual, and your initials in the applicable column.

NOTE:     Refer to the Revision History in the TRANSMITTAL INFORMATION section for revision data.

| Revision Number | Revision Date | Date Put in Manual | By | | Revision Number | Revision Date | Date Put in Manual | By |
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# RECORD OF TEMPORARY REVISIONS

Instructions on each page of a temporary revision tell you where to put the pages in your manual. Remove the temporary revision pages only when discard instructions are given. For each temporary revision, put the applicable data in the record columns on this page.

Definition of Status column: A TR may be active, incorporated, or deleted. "Active" is entered by the holder of the manual. "Incorporated" means a TR has been incorporated into the manual and includes the revision number of the manual when the TR was incorporated. "Deleted" means a TR has been replaced by another TR, a TR number will not be issued, or a TR has been deleted.

| Temporary Revision Number | Status | Page Number | Issue Date | Date Put in Manual | By | Date Removed from Manual | By |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

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# SERVICE BULLETIN LIST

Refer to Table INTRO-2 for other applicable service information documents not listed in the Service Bulletin List.

| Service Bulletin / Revision Number | Title | Modification | Date Put in Manual |
|---|---|---|---|
| 89000016-34-0001 (D201603000071) | NAVIGATION - KGX 150/130 TRANSCEIVERS AND RECEIVERS AUTOMATIC DEPENDENT SURVEILLANCE BROADCAST (ADS-B) UNIVERSAL ACCESS TRANSMITTERS (UAT) - Software Upgrade Service Bulletin | | 22 Dec 2016 |

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| 3042 | * 22 Dec 2016 | 5002 | * 22 Dec 2016 |
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| 3044 | 22 Dec 2016 | 5004 | 22 Dec 2016 |
| 3045 | * 22 Dec 2016 | Serial Interface Specifications | |
| 3046 | * 22 Dec 2016 | | |
| 3047 | * 22 Dec 2016 | 6001 | * 22 Dec 2016 |
| 3048 | * 22 Dec 2016 | 6002 | 22 Dec 2016 |
| 3049 | * 22 Dec 2016 | ADS-B Compliance | |
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# INTRODUCTION

## 1. How to Use This Manual

### A. General

(1) This publication gives maintenance instructions for the equipment shown on the Title page.

(2) Standard maintenance procedures that technicians must know are not given in this manual.

(3) This publication is written in agreement with the ATA Specification.

(4) Warnings, cautions, and notes in this manual give the data that follows:

- A WARNING gives a condition or tells personnel what part of an operation or maintenance procedure, which if not obeyed, can cause injury or death

- A CAUTION gives a condition or tells personnel what part of an operation or maintenance procedure, which if not obeyed, can cause damage to the equipment.

- A NOTE gives data, not commands. The NOTE helps personnel when they do the related instruction.

(5) Warnings and cautions go before the applicable paragraph or step. Notes follow the applicable paragraph or step.

### B. Observance of Manual Instructions

(1) Make sure that you carefully obey all safety, quality, operation, and shop procedures for the unit.

(2) All personnel who operate equipment and do maintenance specified in this manual must know and obey the safety precautions.

### C. Symbols

(1) The symbols and special characters are in agreement with IEEE Publication 260 and IEC Publication 27. Special characters in text are spelled out.

(2) The signal mnemonics, unit control designators, and test designators are shown in capital letters.

(3) The signal names followed by an "*" show an active low signal.

(4) Some figures in this manual incorporate standard geometric characteristic symbols. Refer to Figure INTRO-1 for the geometric characteristic symbols.

## CHARACTERISTIC SYMBOLS

⫭ FLATNESS

— STRAIGHTNESS

○ CIRCULARITY

⌭ CYLINDRICITY

⌒ PROFILE OF A SURFACE

⌒ PROFILE OF A LINE

◎ CONCENTRICITY

⊥ PERPENDICULARITY

// PARALLELISM

∠ ANGULARITY

↗ CIRCULAR RUN OUT

⊕ POSITION

⚌ SYMMETRY

### MODIFYING SYMBOLS

Ⓜ MAXIMUM MATERIAL CONDITION (MMC)

Ⓢ REGARDLESS OF FEATURE SIZE (RFS)

Ⓟ PROJECTED TOLERANCE ZONE

### OTHER SYMBOLS

⌀ DIAMETER

▱ NEGATIVE NOTATION

### FEATURE CONTROL FRAME

TOLERANCE, IN. (MM)

| ⌒ | 0.010 (0.25) | A |

"ALL AROUND" SYMBOL — DATUM REFERENCE

CHARACTERISTIC SYMBOL

TOLERANCE, IN. (MM)

| ⊥ | 0.010 (0.25) Ⓜ | A Ⓜ |

CONDITION-OF-SIZE MODIFIER FOR DATUM FEATURE A

CONDITION-OF-SIZE MODIFIER FOR THE CONTROLLED FEATURE

EXCEPT WHEN THE DATUM(S) OR CONTROLLED FEATURE IS A PLANE SURFACE, A MODIFIER IS REQUIRED PER GENERAL RULE 1 OR MAY BE USED TO ALTER GENERAL RULE 2

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**Figure INTRO-1. (Sheet 1 of 2) Geometric Tolerance Symbols**

## GENERAL RULES

1. POSITION (⌖) TOLERANCES AND THEIR RELATED DATUMS APPLY AT MMC OR RFS AS SPECIFIED IN THE FEATURE CONTROL FRAME.

2. EXCEPT FOR POSITION (⌖), ALL TOLERANCES AND THEIR RELATED DATUMS APPLY RFS UNLESS OTHERWISE SPECIFIED.

3. ALL GEOMETRIC TOLERANCES ARE SPECIFIED AS TOTAL VALUES (TOTAL DIAMETER, TOTAL THICKNESS, TOTAL WIDTH, OR TOTAL ON RADIUS).

4. WHEN TWO DATUM FEATURES ARE REFERENCED IN HYPHENATED FORM, A-B , A SINGLE DATUM IS ESTABLISHED BY THE TWO FEATURES.

5. WHEN TWO OR THREE DATUMS ARE REFERENCED IN SUCCEEDING FRAMES, A B C , THE ORDER OF PRECEDENCE IS LEFT TO RIGHT.

## SAMPLE INTERPRETATIONS

-A- THIS IS DATUM FEATURE A WHICH IS USED TO CREATE DATUM A IN THE PROCESSING EQUIPMENT.

⟋ 0.010 (0.25) THIS SURFACE MUST BE FLAT WITHIN 0.010 IN. (0.25 MM) TOTAL (MEETING EITHER SYSTEM WILL ACCEPT THE PART).

// 0.010 (0.25) B / -C- THIS IS DATUM FEATURE C AND, RFS MUST BE PARALLEL TO DATUM B, RFS, WITHIN 0.010 IN. (0.25 MM) TOTAL.

↗ 0.0005 (0.013) A-B EACH CIRCULAR ELEMENT OF THIS FEATURE, RFS, MUST NOT RUN OUT MORE THAN 0.0005 IN. (0.013 MM) FIM, WITH RESPECT TO THE DATUM ESTABLISHED BY FEATURES A AND B, BOTH RFS.

⌖ ⌀ 0.010 (0.25) Ⓜ A B Ⓜ C Ⓜ THE AXIS OF THIS FEATURE, WHEN THIS FEATURE IS AT MMC, MUST BE LOCATED WITHIN 0.010 IN. (0.25 MM) DIAMETER OF THE TRUE (BASIC) LOCATION ESTABLISHED IN RELATION TO THE PRIMARY SURFACE DATUM A, SECONDARY DATUM B AT MMC, AND TERTIARY DATUM C AT MMC.

⊥ ⌀ 0.010 (0.25) Ⓜ A / 0.500 (12.7) Ⓟ THE AXIS OF THIS FEATURE, WHEN THIS FEATURE IS AT MMC, MUST BE PERPENDICULAR TO DATUM A, RFS, WITHIN A 0.010 IN. (0.25 MM) DIAMETER TOLERANCE ZONE PROJECTED 0.500 IN. (12.7 MM) ABOVE THE SURFACE.

∠ ⟋ THE ANGULAR ORIENTATION OF THIS FEATURE NEED NOT BE CONTROLLED WITH RESPECT TO ANY OTHER FEATURE.

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**Figure INTRO-1. (Sheet 2 of 2) Geometric Tolerance Symbols**

(5) The symbols in Figure INTRO-2 show ESDS and moisture sensitive devices.

**ESDS**     **MOISTURE SENSITIVE**

ID-112405
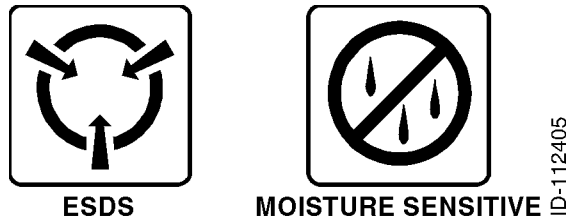
**Figure INTRO-2. (Sheet 1 of 1) Symbols**

**D.  Units of Measure**

(1)  Measurements, weights, temperatures, dimensions, and other values are expressed in the USMS followed by the appropriate SI metric units in parentheses. Some standard tools or parts such as drills, taps, bolts, nuts, etc. do not have an equivalent.

**E.  Page Number Block Explanation**

(1)  The data in this manual is divided into sections. A standard page number block system is used. Page number blocks are shown in Table INTRO-1.

**Table INTRO-1.  Page Number Blocks**

| Section | Page Number Block |
|---|---|
| GENERAL INFORMATION | 1 thru 999 |
| INSTALLATION | 1001 thru 1999 |
| SYSTEM INTERCONNECT DIAGRAMS | 2001 thru 2999 |
| CONFIGURATION, CALIBRATION, AND CHECKOUT | 3001 thru 3999 |
| TROUBLESHOOTING | 4001 thru 4999 |
| RTCA DO-160 ENVIRONMENTAL QUALIFICATION | 5001 thru 5999 |
| SERIAL INTERFACE SPECIFICATIONS | 6001 thru 6999 |
| ADS-B COMPLIANCE | 7001 thru 7999 |
| WIFI MODULE | 8001 thru 8999 |

**F.  Standard Practices Manual**

(1)  Standard cleaning, check, repair, and assembly procedures applicable to multiple models can be found in a standard practices manual. Refer to Paragraph 3.

**G.  Electrostatic Discharge**

(1)  Touch the items susceptible to electrostatic discharge in accordance with MIL-HDBK-263. Refer to MIL-STD-1686 for definition of the standards and conditions.

## 2.  Customer Support

**A.  Honeywell Aerospace Online Technical Publications Website**

(1)  Go to the Honeywell Online Technical Publications Website at (www.myaerospace.com).

• To download or see publications online

- To order a publication

- To tell Honeywell of a possible data error in a publication.

**B. BendixKing Customer Support**

(1) If you do not have access to the Honeywell Technical Publications Website, or if you need to speak to personnel about non-Technical Publication matters, contact BendixKing Customer Support at:

- Telephone: 855-250-7027 (Toll Free U.S.A./Canada)

- Telephone: 505-903-6148 (International)

- Website: www.bendixking.com/support

- Email: techsupport@bendixking.com.

## 3. References

**A. Honeywell/Vendor Publications**

(1) Honeywell publications related to the content of this manual are shown in the list that follows:

- Pub. No. D201405000060, BendixKing KGX 150/130 ADS-B Certified Transceivers and Receivers Pilot's Guide

- ATA No. 20-00-03 (Pub. No. A09-1100-004), Standard Repair Procedures for Honeywell Avionics Equipment Instruction Manual.

**B. Other Publications**

(1) These publications are standard references. Check for latest version of publication.

- The United States GPO Style Manual (available at http://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/content-detail.html)

- IEEE Std 260.1, Standard Letter Symbols for Units of Measurement (available from the American National Standards Institute at http://www.ansi.org)

- ASME Y14.38, Abbreviations for Use on Drawings and Related Documents (available from the American National Standards Institute at http://www.ansi.org)

- ASME Y14.5, Dimensioning and Tolerancing (available from the American National Standards Institute at http://www.ansi.org)

- ANSI/IEEE Std 91, Graphic Symbols for Logic Functions (available from the American National Standards Institute at http://www.ansi.org)

- CAGE codes and manufacturers' addresses are available at https://cage.dla.mil.

- IEEE 315/ANSI Y32.2, Graphic Symbols for Electrical and Electronics Diagrams (available from the American National Standards Institute at http://www.ansi.org)

- MIL-HDBK-263, Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric) (available from any military standards database)

- MIL-STD-1686, Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric) (available from any military standards database).

## 4. Acronyms and Abbreviations

**A. General**

(1) The abbreviations are used in agreement with ASME Y14.38.

(2) Acronyms and non-standard abbreviations used in this publication are as follows.

**List of Acronyms and Abbreviations**

| Term | Full Term |
| --- | --- |
| µs | microsecond |
| AC | advisory circular |
| ADC | air data computer |
| ADF | automatic direction finder |
| ADS-B | automatic dependent surveillance-broadcast |
| ADS | altitude/air data sensor |
| AM | amplitude modulation |
| AMP | ampere |
| ANSI | American National Standards Institute |
| AR | as required |
| ARINC | Aeronautical Radio, Incorporated |
| AS | associated |
| ASME | American Society of Mechanical Engineers |
| ATA | Air Transport Association |
| ATC | Air Traffic Control |
| ATCRBS | air traffic control radar beacon system |
| AWG | American wire gauge |
| BIT | built-in test |
| bps | bits per second |
| C | Celsius |
| CAGE | commercial and government entity |
| CDTI | cockpit display of traffic information |
| cm | centimeter |
| COMM | communication |
| D-sub | D-subminiature |
| dB | decibel |
| dBm | decibel referenced to 1 milliwatt |
| DC | direct current |
| DME | distance measuring equipment |
| E/W | East/West |
| ECCN | export control classification number |
| ENT | enter |
| EPDM | ethylene propylene diene monomer |

**List of Acronyms and Abbreviations (Cont)**

| Term | Full Term |
|------|-----------|
| ESDS | electrostatic discharge sensitive |
| ETA | estimated time of arrival |
| ETSO | European technical standard order |
| ETX | end-of-text |
| ETX | end-of-transmission |
| EUT | equipment under test |
| F | Fahrenheit |
| FAA | Federal Aviation Administration |
| FAR | Federal Aviation Regulation |
| FCC | Federal Communications Commission |
| FIS-B | flight information service-broadcast |
| FMS | Flight Management System |
| FN | function |
| FOM | figure of merit |
| G-Dest | general destination |
| GHz | gigahertz |
| gm | gram |
| GND | ground |
| GNSS | global navigation satellite system |
| GPO | Government Printing Office |
| GPS | global positioning system |
| GUI | graphical user interface |
| HAE | high altitude endurance |
| HDOP | horizontal dilution of precision |
| HFOM | horizontal figure of merit |
| HIL | horizontal integrity limit |
| hPa | hectopascal |
| Hz | hertz |
| I/O | input/output |
| I | input |
| ID | identification |
| IDENT | identify |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |

**List of Acronyms and Abbreviations (Cont)**

| Term | Full Term |
|------|-----------|
| in-Hg | inches of mercury |
| IP | internet protocol |
| k | kilo |
| kBaud | kilobaud |
| kg | kilogram |
| km | kilometer |
| LAN | local area network |
| LCD | liquid crystal display |
| LED | light-emitting diode |
| m/sec | meters per second |
| m | meter |
| mA | milliampere |
| MAX | maximum |
| METAR | meteorological terminal air report |
| MHz | megahertz |
| MIN | minimum |
| mm | millimeter |
| MOPS | minimum operational performance standards |
| MPI | maintenance port interface |
| MSL | mean sea level |
| N/S | North/South |
| NACv | navigation accuracy category for velocity |
| NEXRAD | next generation radar |
| No. | number |
| NOTAM | notice to airmen |
| O | output |
| PBIT | periodic built-in test |
| PC | personal computer |
| PM | personality module |
| PMA | parts manufacturer approval |
| PN | part number |
| POST | power-on self-test |
| PPS | pulse-per-second |
| PRAIM | predictive receiver autonomous integrity monitering |

**List of Acronyms and Abbreviations (Cont)**

| Term | Full Term |
|------|-----------|
| PSU | power switching unit |
| Pub. | publication |
| Pwr | power |
| Qty | quantity |
| RAIM | receiver autonomous integrity monitering |
| RF | radio frequency |
| RI | resolution instruction |
| RTCA | Radio Technical Commission for Aeronautics |
| RTS | request-to-send |
| Rx | receive |
| SATCOM | satellite communication |
| SBAS | S-band antenna switch |
| SI | International System of Units |
| SIGMET | significant meteorological information |
| SIM | system installation manual |
| Spec. | specification |
| SSI | signal strength indication |
| STC | supplemental type certificate |
| STX | start-of-text |
| T/R | transmit/receive |
| TA | traffic advisory |
| TC | type certificate |
| TCAS | traffic alert and collision avoidance system |
| TCP | transmission control protocol |
| TMAP | proprietary RS485 data bus |
| TNC | threaded Neill-Concelman |
| TO | time out |
| TR | temporary revision |
| TSO | technical standard order |
| Tx | transmit |
| UAT | universal access transceiver |
| UAV | unmanned aerial vehicle |
| ULM | ultra light motorized |
| USB | universal serial bus |

**List of Acronyms and Abbreviations (Cont)**

| Term | Full Term |
|------|-----------|
| USMS | United States Measurement System |
| UTC | universal time coordinated |
| VDC | volts direct current |
| VDOP | vertical dilution of precision |
| VFOM | vertical figure of merit |
| VFR | visual flight rule |
| VIL | vertical integrity limit |
| VSWR | voltage standing wave ratio |
| WiFi | wireless fidelity |

B. **Service Information Documents**

(1) Refer to Table INTRO-2 for other applicable service information documents not listed in the Service Bulletin List.

**Table INTRO-2.  Service Information Documents**

| Document Type | Document Number /Revision Number | Title | Date Put In Manual |
|---------------|----------------------------------|-------|--------------------|
| SIL | D201608000055 /0 | KGX Series, PN 89000016-130, -131, -150, and -151 - Software Release 001H, Added Compatibility with BendixKing KSN 765/770 as a Global Positioning System (GPS) Input Source | 22 Dec 2016 |

# GENERAL INFORMATION

## 1. Introduction

### A. General

(1) This document contains installation data and specifications about the BendixKing KGX series product line. Table 1 specifies the applicable part numbers.

**Table 1. Installation Manual Applicability**

| Honeywell Part Number | Component |
|---|---|
| 89000016-130 | KGX 130T ADS-B TRANSCEIVER WITHOUT INTERNAL GPS |
| 89000016-131 | KGX 130R ADS-B RECEIVER WITHOUT INTERNAL GPS |
| 89000016-150 | KGX 150R ADS-B RECEIVER WITH INTERNAL GPS |
| 89000016-151 | KGX 150T ADS-B TRANSCEIVER WITH INTERNAL GPS |
| 89000016-001 | KGX CONTROL PANEL (OPTIONAL) |
| 89000016-002 | KGX WiFi MODULE (OPTIONAL) |
| 89000016-004 | KGX 150/130 INSTALLATION KIT |
| 89000016-017 | WiFi MODULE INSTALLATION KIT |

## 2. General System Description

### A. General

(1) The KGX 150T/130T transceiver provides both UAT transmit (ADS-B Out) and UAT receive (ADS-B In) capability. The KGX 150R/130R receiver provides UAT receive (ADS-B In) capability only and are intended for use with external ADS-B Out transmitters, including Mode-S transponders with built-in ADS-B Out. The KGX series satisfy the TSO requirements and the associated MOPS for UAT ADS-B class A1H/A1S/B1S equipment.

(2) The KGX 150T/130T transceiver transmits aircraft position, velocity, and other flight data to other aircraft and ground station equipment through a UAT data link once each second (ADS-B Out). The KGX 150/130 transceivers and receivers receive aircraft position, velocity, and other flight data from other aircraft and ground station equipment through a UAT data link (ADS-B In). GPS data, pressure altitude data, TCAS, and pilot control inputs are received by the KGX 150/130 transceivers and receivers through configurable RS-232/422 serial, ARINC 429, and/or discrete interfaces. ADS-B and TCAS Traffic, FIS-B (NEXRAD, METARs, NOTAMs, SIGMETs, etc.) information, system health/status, etc. are output on multiple configured serial links and/or discrete signals to be connected to pilot displays.

(3) In Figure 1, the installation shows a display controller, KGX 150 transceiver, two UAT antennas, and a GPS antenna. Additionally, connections are shown to an external altitude sensor (shared with the transponder), the transponder suppression bus, and an air/ground detection switch. The GPS data can optionally be provided by an existing aircraft GPS source if it meets the interface requirements of the KGX (RS-232 or RS-422) such as the FreeFlight Systems 1201, Garmin Series 400/500 with GPS ADS-B Plus Interface, or ARINC 743A compatible GPS (e.g. 1203/1203C) through an ARINC 429 bus, or serial connection.

(4)  Refer to Figure 1 and Figure 2 for a typical installation. These figures also depict installations using an aircraft mounted KGX WiFi module in place of a dedicated MPI port. This allows traffic and weather data to be shared with a portable electronic device in flight, and can be used to simplify system configuration during maintenance activities.
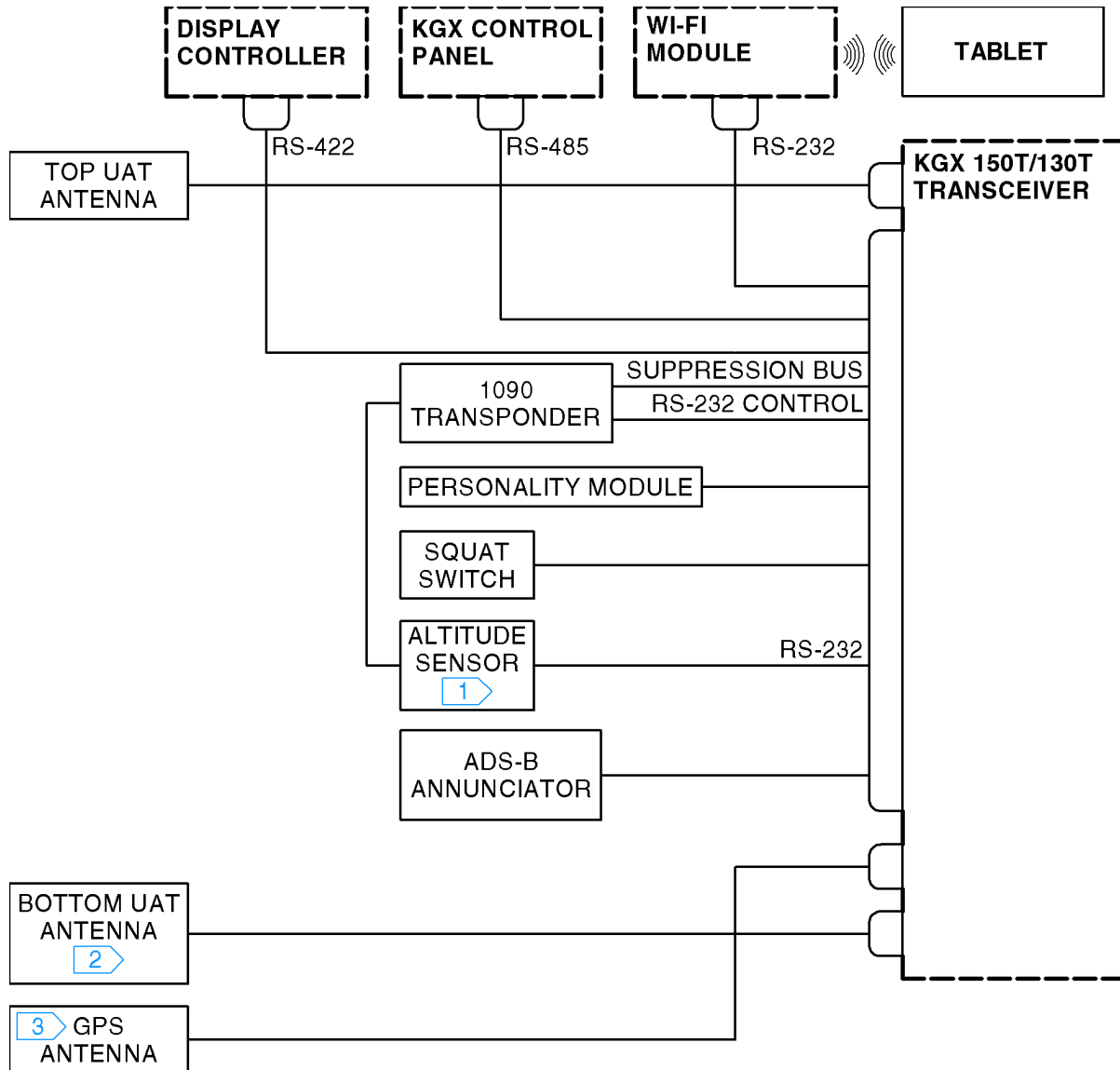
**NOTES:**

1 The KGX 150T/130T and the transponder must receive altitude data obtained from the same pressure altitude source.

2 The KGX 150T/130T can be installed with either a single or double UAT antenna configuration. There are no diversity requirements for receive only.

3 The GPS antenna is for the 150 Series only.

ID-613117

**Figure 1. (Sheet 1 of 1) Typical KGX 150T/130T Transceiver Installation**

**Figure 2. (Sheet 1 of 1) Typical KGX 150R/130R Receiver Installation**
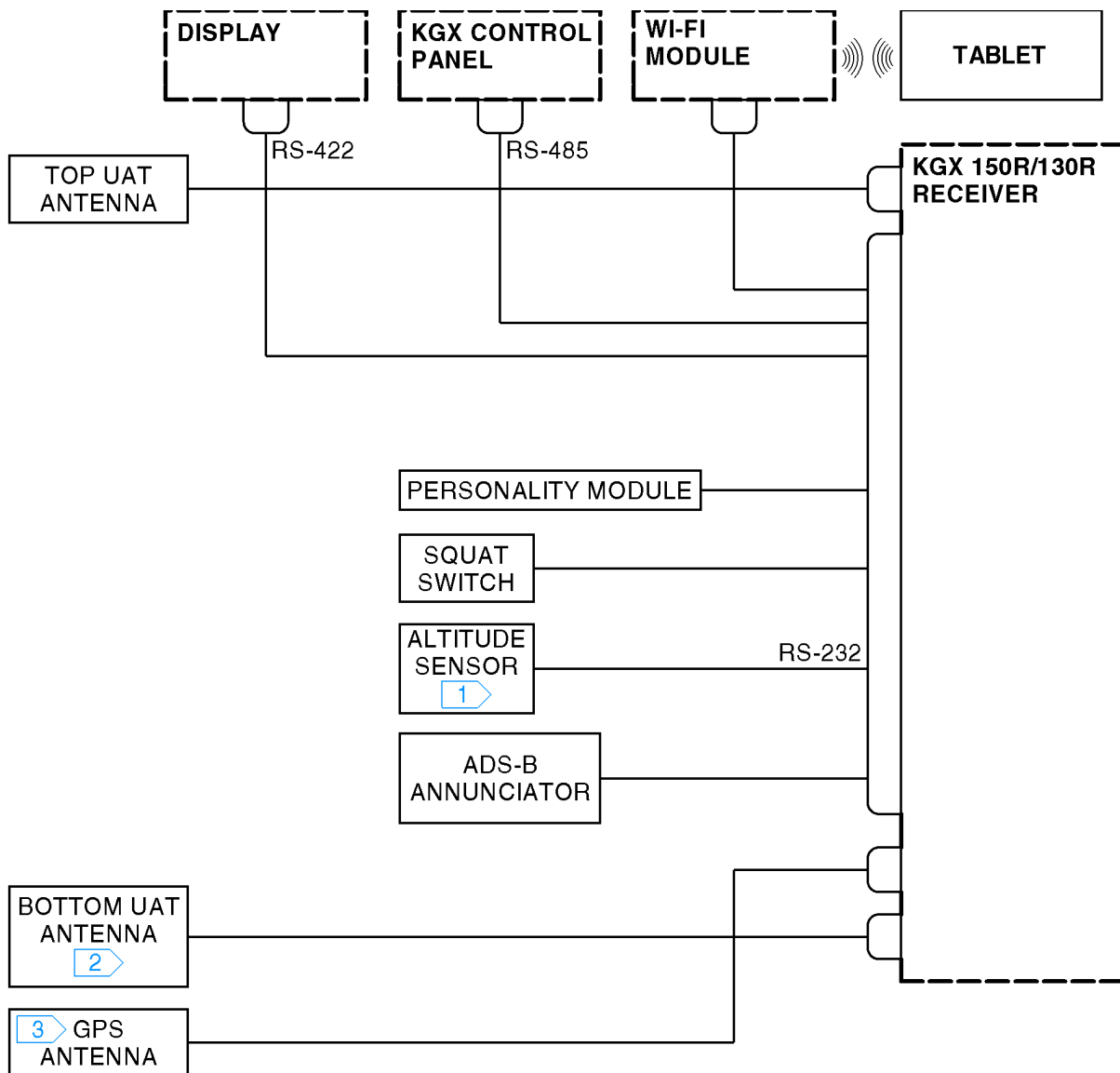
NOTES:

1 The KGX 150R/130R must receive pressure altitude data however it does not have to be from the same pressure altitude sensor as the transponder.

2 The KGX 150T/130T can be installed with either a single or double UAT antenna configuration. There are no diversity requirements for receive only.

3 The GPS antenna is for the 150 Series only.

ID-613118

(5)   The main difference between installations is the receiver installation does not require any connections to a transponder or transponder transmit control and is not required to obtain pressure altitude data from the same altitude sensor used by the transponder. GPS data and pressure altitude sensor data are required for receivers as well as transceivers.

(6) Installations where the transponder and/or display can't supply the required control and status, the KGX control panel can optionally be used to control the UAT transmitter and display status. The KGX control panel also contains a TSO-C88b and ETSO-C88a certified pressure altitude encoder and RS-232 serial output to share altitude sensor data with a transponder. The KGX control panel also displays the pressure altitude received directly by the KGX 150T/130T transceivers and outputs the altitude on its RS-232 serial output.

**B.    KGX 150/130 Features**

(1) Refer to Figure 3 for the KGX 150/130 transceivers and receivers.

(2) The KGX 150/130 transceivers and receivers have identical connectors, pin-outs, size, and mounting requirements. The KGX series has a DB-44 female connector, a USB micro-AB maintenance connector, and two TNC UAT antenna connectors. The KGX series also includes four status LEDs, configurable serial interfaces (controller input, GPS input/output, altitude/air data input, TCAS input, multiple display outputs, and maintenance port interface), Discrete input/output, and a personality module interface. A short summary of the KGX 150/130 transceiver and receiver features follows.

(a) The KGX 150 models with the internal GPS/SBAS sensor have an additional TNC connector. The KGX 150 models supply a TSO-C145c Class Beta 1 certified GPS/SBAS data output on serial Port 1. Compliant equipment can be interfaced through RS-232 serial Port 1.

(b) The KGX 130 models can connect to any compliant GPS (e.g. FreeFlight Systems 1201), Garmin series 400W/500W with GPS ADS-B Plus interface, or Bendix King KSN 765/770 GPS interface through an RS-232 serial port or an ARINC 743A compatible GPS (e.g. FreeFlight systems 1203/1203C) through an ARINC 429 bus.

(c) The status LEDs (ST - UAT status, GPS - GPS status, TX - UAT Tx, and RX - UAT Rx) indicate the status of the unit during operation.

(d) The KGX control panel (optional) - An optional KGX control panel interface receives low voltage power and provides system on/off discrete control, and a communications interface on serial Port 3 of the KGX. The system can also be configured using the KGX control panel. When a KGX control panel is not installed, serial Port 3 can be used as a display port and/or a maintenance port.

(e) Configurable Serial Interfaces - Five RS-232 serial ports, one RS-422 port (that can be configured as an additional RS-232 port), two ARINC-429 input ports, and one ARINC-429 output port can be installation configured to interface to transponder controllers, GPS input/output, altitude/air data input, TCAS Input, multiple display outputs, and maintenance PC/tablet.

(f) Discrete Inputs/Outputs - Three discrete inputs (air/ground switch, traffic test, and anonymous mode) and two discrete outputs (transmit suppression and UAT status) supply control and status feedback.

(g) UAT Antennas - There are two (top and bottom) UAT antenna connectors. The units can be configured to use the top, bottom, or both (diversity) antennas.

(h) Personality Module Interface (Optional) - An optional personality module installed in the DB-44 connector backshell on the KGX allows configuration settings to automatically be retrieved and set when a transceiver or receiver unit is removed and replaced in the aircraft.

ID-499437

**Figure 3. (Sheet 1 of 1) KGX 150/130 Transceivers and Receivers**

### C. KGX Control Panel (Optional)

(1) Installations where the transponder and/or display can't give the required control and status, the KGX control panel can optionally be used to control the UAT transmitter and display status. The KGX control panel also contains a TSO-C88b and ETSO-C88a certified pressure altitude encoder and RS-232 serial output to share altitude sensor data with a transponder. The KGX control panel also displays the pressure altitude received directly by the KGX 150T/130T transceivers and outputs the altitude on its RS-232 serial output.

(2) The KGX control panel has a DB-9 connector for electrical interface and a static pressure port. The KGX control panel contains:

- An LCD display with controls

- A built-in altitude encoder

- A low-voltage input power interface

- A KGX 150/130 transceivers serial interface

- A remote on/off power control

- A serial altitude output.

(3) The KGX control panel is not required if the KGX 150T/130T transceiver is connected to a transmit controller (transponder) and/or display that can supply, as a minimum:

- Mode A code entry and display

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- IDENT control and display

- Display ADS-B transmit and ADS-B position failure status.

(4) Refer to Figure 4 for the KGX control panel.

    NOTE: Polarized sunglasses can interfere with the display visibility of the KGX control panel.



**Figure 4. (Sheet 1 of 1) KGX Control Panel**

(5) Display and Controls

    (a) It has a LCD status display, an IDT (identify) button, a VFR (visual flight rule) button, a FN (function) button, ENT (enter) button, a mode selection knob, and a CODE entry knob.

(6) Altitude Encoder

    (a) It has a built-in altitude encoder to measure pressure altitude.

(7) Input Power

    (a) It receives low-voltage power from the KGX 150/130 transceivers.

(8) Serial Interface

    (a) An RS-485 serial data link is used to connect the KGX control panel to the KGX 150/130 transceivers.

(9) Remote On/Off

    (a) System on/off power is controlled with the mode selection knob.

(10) Altitude Output

    (a) Pressure altitude data is output on an RS-232 serial port.

**D. UAT Antenna Requirements**

(1) The KGX 150/130 transceivers and receivers require a TSO-C66, C74, C112, or C154 UHF antenna(s). Make sure that the antenna has a 50-ohm impedance with a VSWR of less than 1.7:1 at 978 MHz. The Honeywell KA 61 UAT antenna (L-band antenna), PN 071-00221-0010, meets these requirements.

(2) In Class A1H ADS-B equipment (TSO-C154c) installations, antenna diversity (meaning a top and bottom antenna) is required. In Class A1S (single antenna) installations only one antenna (bottom) is used. For airworthiness approval of ADS-B out systems (AC 20-165A) single bottom mounted antenna (TSO-C154c Class A1S) installations are allowed.

E. **GPS Antenna Requirements**

(1) The KGX 150 series requires a TSO-C144 (DO-228) or TSO-C190 (DO-301) compliant GPS antenna. Installation of a TSO-C190 antenna is only recommended for anticipated future upgrades to TSO-C145c Class Beta 2, 3, 4 navigation sensors and avoids the need for a GPS antenna change at that time.

(2) The performance of the KGX 150 series internal GPS is affected by the gain, noise figure, impedance, and frequency selectivity characteristics of the antenna. The KGX series must only be used with the recommended antenna and cable. Refer to Paragraph 3.B. and Paragraph 4.B. Use of other antennas or cables may not meet all the performance characteristics required by TSO-C145c.

## 3. Technical Characteristics

A. **KGX 150/130 Transceivers and Receivers, PN 89000016-130, -131, -150, and -151**

(1) Refer to Table 2 for the KGX 150/130 transceivers and receivers leading particulars.

**Table 2. KGX 150/130 Transceivers and Receivers Leading Particulars**

| Characteristic | Specification |
|---|---|
| Environmental compliance | Refer to the RTCA DO-160 ENVIRONMENTAL QUALIFICATION section |
| TSO compliance | C145c (Beta 1), PNs 89000016-150 and -151 only<br>C154c (A1H/A1S)<br>C157a (Class 1) incomplete system<br>C195a (Class C1) |
| FCC identification | T7YFDL978XXXX |
| Software | RTCA DO-178B Level C |
| Hardware | RTCA DO-254 Level C |
| Height | 1.7 inches (43.2 mm) |
| Width | 5.0 inches (127.0 mm) |
| Depth | 5.5 inches (139.7 mm) |
| Weight | 0.86 pounds (0.39 kg)<br>0.98 pounds (0.44 kg) with internal GPS |
| Temperature: | |
| • Operating | $-40$ to $+158°$F ($-40$ to $+70°$C) |
| • Storage | $-67$ to $+185°$F ($-55$ to $+85°$C) |
| Altitude | 50,000 feet (15.24 km) |
| Power requirements: | 10 to 40 VDC |
| • Typical | 0.22 AMP (0.34 AMP with GPS) at 28 VDC |
| • Peak | 0.72 AMP (0.84 AMP with GPS) at 28 VDC |
| Transceiver frequency | 978 MHz |

**Table 2.  KGX 150/130 Transceivers and Receivers Leading Particulars (Cont)**

| Characteristic | Specification |
|---|---|
| Transmitter power | 40 watts MAX at antenna after 2-dB connector/cable losses |
| Receiver sensitivity | −99 dBm |

(2)    Refer to Table 3 for the avionics interfaces.

**Table 3.  Avionics Interfaces**

| Type | I/O | Description |
|---|---|---|
| KGX control panel | I/O | 7-VDC power output, remote on/off discrete input, RS-485 serial interface to the KGX control panel |
| GPS input | Input | Serial (RS-232, RS-422, or RS-485) or ARINC 429 (ARINC 743 A/B) and PPS (ARINC 743 A/B) |
| ADS/altitude input | Input | Serial (RS-232, RS-422, or RS-485) or ARINC 429 |
| Display output | Output | Serial (RS-232, RS-422, or RS-485) or ARINC 429 |
| Discrete inputs | Input | 3 (air/GND, traffic test, and anonymous mode) |
| Discrete outputs | Output | 2 (transmit suppression and UAT status) |
| GPS output (KGX 150 series only) | Output | Serial RS-232 or ARINC 429 - Internal GPS models only, PNs 89000016-150 and -151 |

**B.   KGX Control Panel**

(1)    Refer to Table 4 for the KGX control panel leading particulars.

**Table 4.  KGX Control Panel Leading Particulars**

| Characteristic | Specification |
|---|---|
| Environmental compliance | Refer to the RTCA DO-160 ENVIRONMENTAL QUALIFICATION section |
| TSO compliance | C154c (incomplete system) C88b |
| ETSO compliance | C88a |
| Software | RTCA DO-178B Level B |
| Height | 1.8 inches (45.7 mm) |
| Width | 2.5 inches (63.5 mm) |
| Depth | 2.8 inches (71.1 mm) |
| Weight | 0.11 pounds (0.05 kg) |
| Operating temperature | −4 to +131°F (−20 to +55°C) |
| Altitude | 35,000 feet (10.67 km) |

**Table 4.  KGX Control Panel Leading Particulars (Cont)**

| Characteristic | Specification |
|---|---|
| Power requirements | 5.5 to 10 VDC, 0.3 AMP MAX at 6.5 VDC, powered by the KGX |
| Interfaces<br><br>Type:<br><br>• KGX control panel<br><br>• Altitude output | <br><br>I/O<br><br>RS-485 I/O<br><br>RS-232 output |

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## INSTALLATION

### 1.  General

#### A.  Overview

(1)  This section provides installation information for the KGX 150/130, the optional KGX control panel, and the optional KGX WiFi module. The equipment must be installed in the aircraft in a manner consistent with acceptable workmanship and engineering practices, and in accordance with the instructions set forth in this publication. To make sure that the system has been properly and safely installed in the aircraft, the installer must make a thorough visual inspection and conduct an overall operational check of the system, on the ground, prior to flight.

(2)  FAA AC 20-165A requires certified installations with ADS-B Out Transmitters (KGX 150/130 transceivers) and any transponder on the aircraft to transmit pressure altitude data obtained from the same altitude sensor source. Installations must therefore make sure that the transponder and KGX 150/130 transceivers receive altitude data from the same altitude sensor.

(3)  FAA AC 20-165A HIGHLY recommends that the ADS-B transmitter and transponder share a single point of entry for Mode A (squawk mode) and IDENT. Dual entry installations are allowed but discouraged and must make sure that the transponder and UAT transmit the same Mode A and IDENT without increased pilot workload. Transponders with serial control data out capability must be connected through a KGX 150/130 transceiver serial port to control Mode A code and IDENT. Mode A/C transponders without serial control data out can use the KGX 150/130 transceiver internal Mode A receiver (configuration setting) which receives the on-board transponder transmissions to automatically set Mode A code and IDENT control data transmit. Mode A receive is not compatible with Mode S transponders.

(4)  KGX 150R/130R require pressure altitude input but are not required to use the same pressure altitude input as the transponder.

### 2.  Unpacking and Inspecting Equipment

#### A.  General

(1)  Exercise care when unpacking each item. Visually inspect each item for evidence of damage incurred during shipment. If a damage claim must be filed, save the shipping container to substantiate the claim. When all equipment and the installation kit have been inspected, save the packing material and container in case the unit is to be stored or reshipped. Refer to Paragraph 3 of the GENERAL INFORMATION section for equipment and optional parts supplied.

### 3.  Parts and Equipment

#### A.  KGX Items

(1)  The KGX and optional equipment part numbers are listed in Table 1001.

**Table 1001.  KGX and Optional Equipment Part Numbers**

| PN | Qty | Description |
|---|---|---|
| 89000016-130 | 1 | KGX 130T ADS-B transceiver with no internal GPS |
| 89000016-131 | 1 | KGX 130R ADS-B receiver with no internal GPS |
| 89000016-150 | 1 | KGX 150R ADS-B receiver with integrated WAAS GPS |
| 89000016-151 | 1 | KGX 150T ADS-B transceiver with integrated WAAS GPS |

**Table 1001. KGX and Optional Equipment Part Numbers (Cont)**

| PN | Qty | Description |
|---|---|---|
| 89000016-001 | 1 | KGX control panel and installation kit |
| 89000016-002 | 1 | KGX WiFi module |
| 89000016-006 | 1 | Personality module and installation kit |
| 071-00221-0010 | 1 | KA 61 UAT antenna |
| 071-01620-0001 | 1 | KA 96 WAAS GPS antenna |
| 89000016-004 | 1 | KGX 150/130 installation kit |
| 89000016-017 | 1 | WiFi module installation kit |

B.    **Installation Kits**

(1)    The items included in the KGX installation kit are listed in Table 1002.

**Table 1002. KGX 150/130 Installation Kit, PN 89000016-004**

| Qty | Description |
|---|---|
| 1 | DB-44 male crimp connector |
| 1 | DB-44 backshell |
| 50 | Crimp pin AWG 24 to 28 |

(2)    The KGX control panel has an installation kit included.  If a replacement installation kit is needed, order PN 89000016-005.  The items included in the KGX control panel installation kit are listed in Table 1003.

**Table 1003. KGX Control Panel and Installation Kit, PN 89000016-001**

| Item | Qty | Description |
|---|---|---|
| 1 | 1 | KGX control panel |
| 2 | 1 | KGX control panel mounting adapter bracket (circular hole adapter) |
| 3 | 1 | Hose EPDM rubber 0.2 inch (5 mm) inside diameter 0.3 inch (8 mm) outside diameter |
| 4 | 1 | Hose connector 3/16 inch (4.8 mm) nylon tee |
| 5 | 2 | Hose adapter straight nylon 3/16 to 1/4 inch (4.8 to 6.4 mm) |
| 6 | 6 | Constant tension clamp application 0.3 to 0.4 inch (8.5 to 9 mm) diameter |
| 7 | 2 | Constant tension clamp application 0.4 to 0.5 inch (9.5 to 10.3) mm diameter |
| 8 | 4 | Screw brass cross recessed csk head black 4-40 UNC × 1.5 inches (38 mm) long |
| 9 | 4 | Screw brass cross recessed csk head black 4-40 UNC × 0.625 inch (15.9 mm) long |

**Table 1003. KGX Control Panel and Installation Kit, PN 89000016-001 (Cont)**

| Item | Qty | Description |
|------|-----|-------------|
| 10 | 1 | Connector accessory backshell nine-way D-Sub three-way entry 4-40UN jackscrew |
| 11 | 1 | Connector standard mount nine-way D-receptacle to M24308 |
| 12 | 9 | Crimp socket contact wire size AWG 20 to 24 |

(3)   The items included in the optional personality module and installation kit, PN 89000016-006, are listed in Table 1004.

**Table 1004. Personality Module and Installation Kit, PN 89000016-006**

| Qty | Description |
|-----|-------------|
| 1 | Personality module |
| 6 | Crimp pin AWG 24 to 28 |
| 1 | Adhesive double sided tape 0.5 inch × 0.5 inch |

(4)   The items included in the optional KA 61 UAT antenna, PN 071-00221-0010, are listed in Table 1005.

**Table 1005. KA 61 UAT Antenna, PN 071-00221-0010**

| PN | Qty | Description |
|----|-----|-------------|
| 071-00221-0010 | 1 | L-band antenna (BNC) |
| 8-32 | 2 | Self-locking cadmium plated carbon hex nut |
| AH-3000-030 | 1 | Backing plate |
| AH-3000-040 | 1 | Installation template |
| Install-AH-3000 | 1 | Installation instructions |

(5)   The items included in the optional TSO-C190 KA 96 WAAS GPS antenna, PN 071-01620-0001, are listed in Table 1006.

**Table 1006. TSO-C190 KA 96 WAAS GPS Antenna, PN 071-01620-0001**

| PN | Qty | Description |
|----|-----|-------------|
| 071-01620-0001 | 1 | KA 96 WAAS GPS antenna |
| 8-32 | 4 | UNC-2A × 1.00 cross recessed oval head, S.S. 303 |
| MS28775-116 | 1 | Nitrile O-ring |

## 4. Materials Required But Not Supplied

### A. Materials Not Supplied

(1) The following items are required for correct installation but not supplied:

- Wire and shielded wire
- Circuit breaker
- Ground terminals
- A valid WAAS GPS receiver with appropriate serial or ARINC 743 interface is required for the KGX 130 Series (no GPS), 130R/130T, PN 89000016-130, -131.

(2) The following GPS receivers listed in Table 1007, have been verified to supply position, velocity, position accuracy, position integrity and velocity accuracy information properly interpreted by the KGX 130 Series:

**Table 1007.  Compatible WAAS GPS Receivers**

| PN | Manufacturer | Model/Description |
|---|---|---|
| 84100-XX-XXXX | FreeFlight Systems | FreeFlight Systems 1201 |
| 84327-XX-XXXX | FreeFlight Systems | FFS 1203/C |
| 010-00409-01 010-00414-01 | Garmin | 400W/500W GPS with ADS-B Plus Interface |
| 066-01204-0101 066-01204-1101 066-01213-0101 066-01213-1101 | BendixKing | KSN 765/770 Safety Navigator |

### B. List of Other Approved WAAS GPS Antennas

(1) The KGX 150 series, PN 89000016-150 or -151, can be installed with the WAAS GPS antennas summarized in Table 1008.

**Table 1008.  Other Approved WAAS GPS Antennas**

| PN [1] | Manufacturer | Model/Description | Mount Style |
|---|---|---|---|
| 071-01620-0001 | Honeywell | KA 96 GPS | Screw mount |
| 575-9 | Aero Antenna | A-33 GPS | Screw mount |
| 575-93 | Aero Antenna | A-34 GPS | Screw mount |

**NOTE:**

**1** To use these antennas they must be connected with a cable having a maximum of 5 dB loss and 1-ohm DC resistance.  Refer to Paragraph 15 in the INSTALLATION section for additional GPS antenna installation guidelines.

## 5. FT-9000 RAMP Tester

### A. General

(1) For KGX series installation checkout, troubleshooting, and system operation verification, as necessary, it is recommended to use the FFS FT-9000 ramp tester.

(2)   The FT -9000 ramp tester kit part number can be ordered as an optional item using the part number specified in Table 1009.

**Table 1009.  FT-9000 RAMP Tester Kit**

| Part Number | Quantity | Description |
|-------------|----------|-------------|
| 87579-00 | 1 | FT-9000 ADS-B RAMP Tester Kit |

## 6.   Equipment Mounting

### A.   KGX Control Panel Mounting

(1)   The KGX control panel must be mounted rigidly in the aircraft panel.  The KGX control panel can be mounted in the ultra-compact mounting hole or in a conventional 2.25 inch (57 mm) instrument cut-out.  Refer to Figure 1003 and Figure 1004.

(2)   The following installation procedure must be followed, remembering to supply adequate space for installation of cables and connectors.

(a)   Select a position in the panel that is not too close to any high external heat source (the KGX control panel is not a significant heat source itself).

(b)   Avoid sharp bends and placing the cables too near to the aircraft control cables.

(c)   If using a 2.25 inch (57 mm) instrument cut-out, first clip the two mounting adapters to the KGX control panel.  It must then be mounted using the four long screws provided.

(d)   If using the ultra-compact cutout, you do not need the mounting adapters.  The KGX control panel must be mounted using the four short screws provided.

(e)   If alternate screws are required, please note that the mounting thread in each case is 4-40.

(3)   Refer to Figure 1001 for the KGX control panel dimensions.
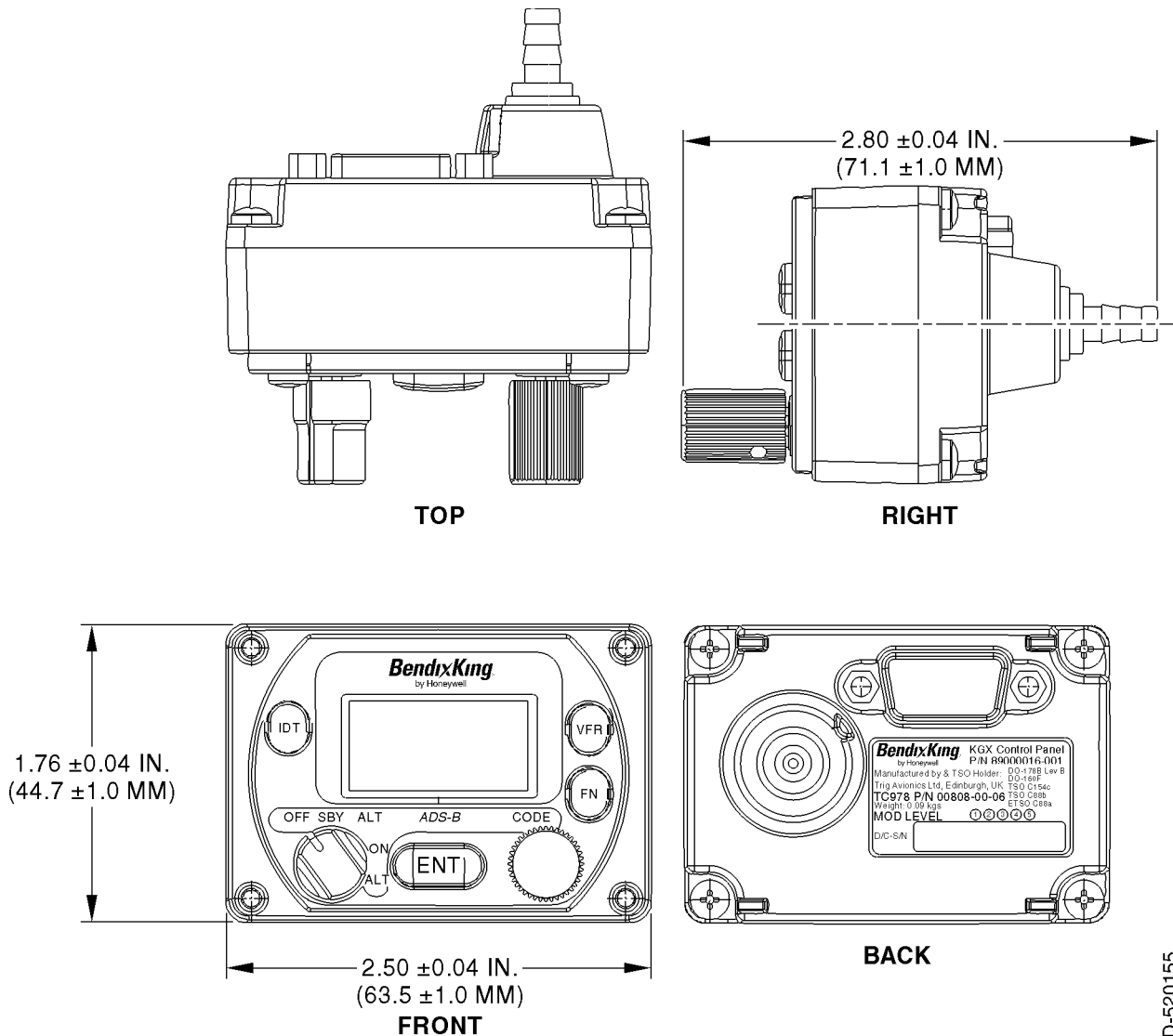
**Figure 1001. (Sheet 1 of 1) KGX Control Panel Dimensions**

**B.   KGX Mounting (All Models)**

(1)   The KGX is designed to be mounted in any convenient location in the cockpit, the cabin, or an avionics bay.

(2)   The following installation procedure must be followed, remembering to supply adequate space for installation of cables and connectors.

(a)   Select a position in the aircraft that is not too close to any high external heat source (the KGX is not a significant heat source itself).

(b)   Avoid sharp bends and placing the cables too near to the aircraft control cables.

(c)   Attach the KGX on a flat surface according to the KGX mounting requirements illustrated in Figure 1002.

4.8 IN.
(121.9 MM)

0.3 IN.
(6.4 MM)

0

0   0

0.3 IN. (7.8 MM)

2.4 IN. (61 MM)

4.5 IN. (114.1 MM)

1.7 IN. (43.2 MM)

0

5.1 IN.
(128.3 MM)

0

5.5 IN.
(138.5 MM)

4.9 IN.
(124.9 MM)

ID-495088
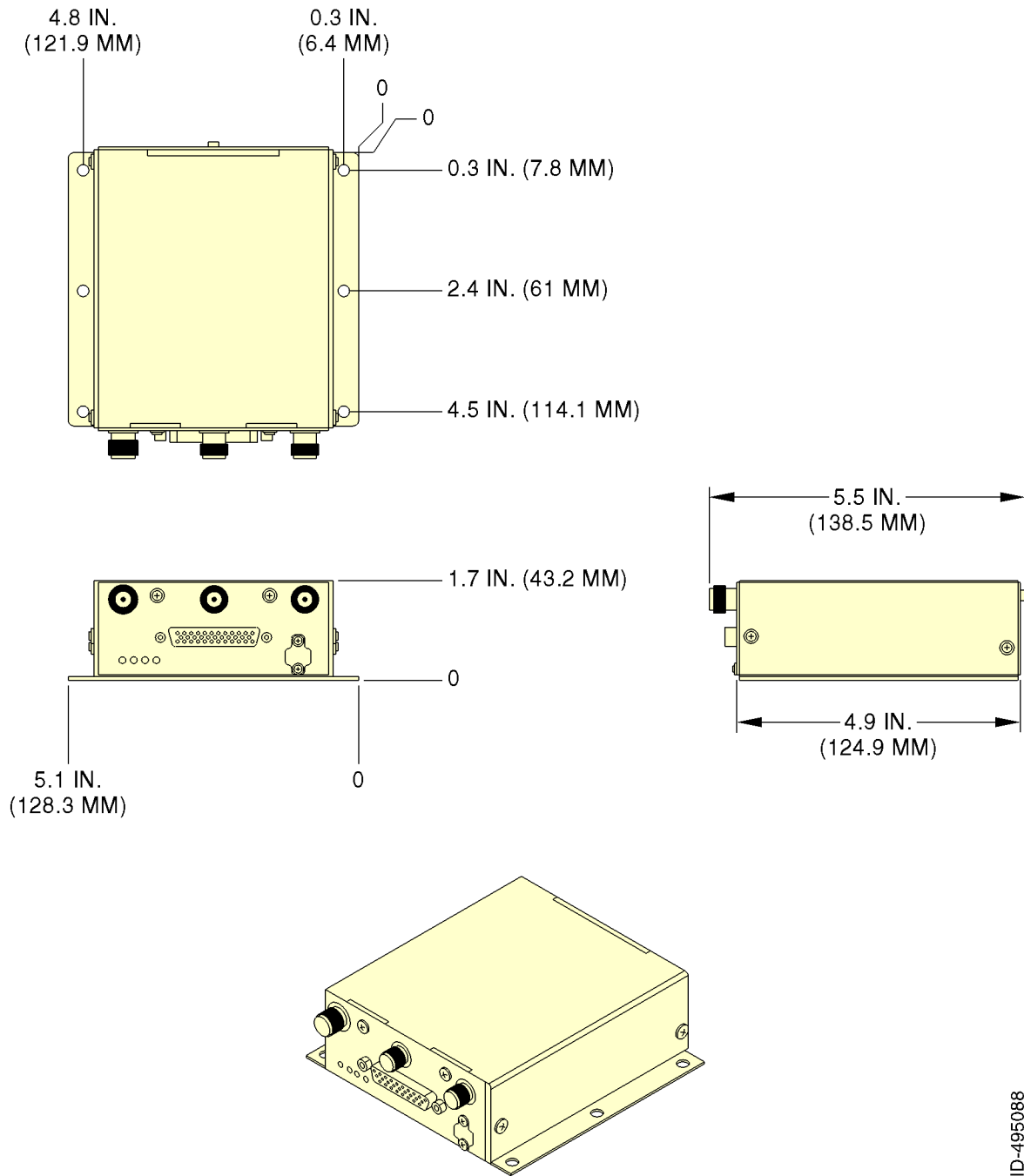
**Figure 1002. (Sheet 1 of 1) KGX Mounting Dimensions**

## 7. KGX Control Panel Cut-Out Options

### A. General

(1)  The KGX control panel can be fitted to either the compact mounting hole or a conventional 2.25-inch (57-mm) instrument cut-out. The compact mounting is a truncated 58-mm opening. Note that the mounting screws are not in the same location for the two options. Refer to Figure 1003 and Figure 1004.

NOTE: Figure 1003 and Figure 1004 are intended to be to scale; however, variations in the printing process mean that you must check all dimensions before using it as a template.
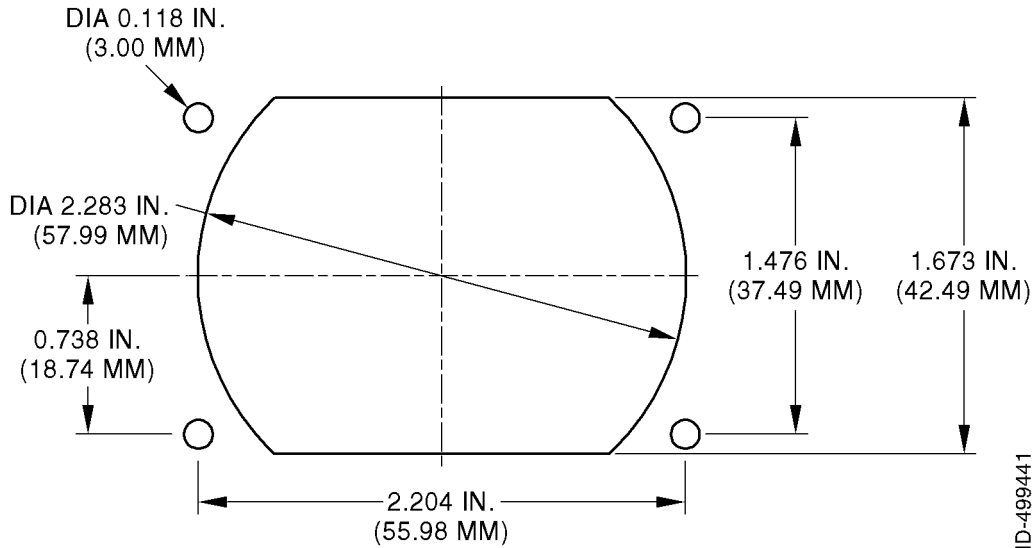


**Figure 1003. (Sheet 1 of 1) KGX Control Panel Ultra-Compact Mounting Hole Cut-Out Option**
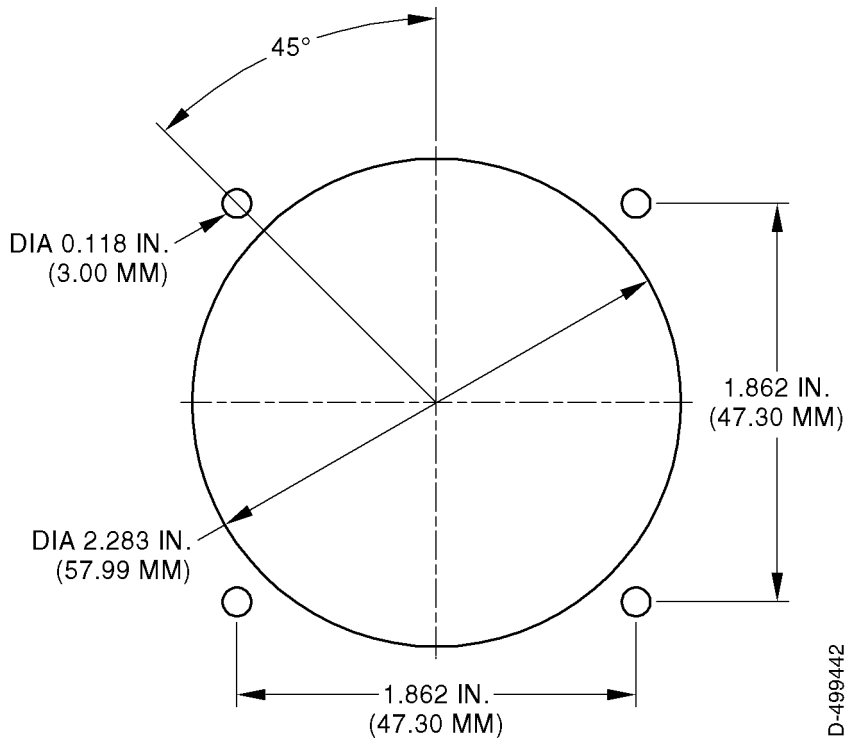


**Figure 1004. (Sheet 1 of 1) KGX Control Panel Standard Mounting Hole Cut-Out Option**

## 8. Cooling Requirements (All Models)

### A. General

(1) The KGX and KGX control panel meet all TSO requirements without forced air cooling. While each individual unit does not require forced air cooling, the combined heat load of several units operating in a typical avionics location can significantly degrade the reliability of avionics if provisions for cooling are not incorporated in the initial installation. Failure to supply adequate cooling can lead to increased avionics maintenance costs and will void the BendixKing Warranty.

## 9. KGX Electrical Connections (All Models)

### A. KGX 150/130 Transceivers and Receivers Interface - Pinout

(1) Refer to Table 1010 for the KGX interface - pinout.

**Table 1010.  KGX Interface - Pinout**

| Pin | Signal | Electrical | I/O | Description |
|---|---|---|---|---|
| **J1 - Power and I/O Connector (DB-44)** |
| 1 | Vin | 10 to 40 VDC | Pwr | Aircraft power input |
| 2 | GND | Ground | GND | KGX control panel power return |
| 3 | 232 RxD2 | RS-232 | I | Serial Port 2 RS-232 data in |
| 4 | 232 RxD1 | RS-232 | I | Serial Port 1 RS-232 data in |
| 5 | 232 TxD1 | RS-232 | O | Serial Port 1 RS-232 data out |
| 6 | 429 IN 2A | ARINC 429 | I | ARINC 429 input Port 2A |
| 7 | TxD6+ | RS-422 | O | Serial Port 6 data out+ |
| 8 | TxD6- [1] | RS-422/RS-232 | O | Serial Port 6 data out− |
| 9 | SGND4 | Serial ground | GND | Serial port ground |
| 10 | 429 OUT 1A | ARINC 429 | O | ARINC 429 output Port 1A |
| 11 | 429 OUT 1B | ARINC 429 | O | ARINC 429 output Port 1B |
| 12 | ANON MODE | Open/ground | I | Anonymous mode, active low |
| 13 | Reserved | N/A | - | N/A |
| 14 | Vpm | 3.0 to 3.6 VDC | O | Personality module power output |
| 15 | TRAF TEST | Open/ground | I | Traffic test |
| 16 | Vin | 10 to 40 VDC | Pwr | Aircraft power input |
| 17 | RTRN | Ground | GND | Aircraft power return |
| 18 | Vcp | 5.5 to 10 VDC | O | KGX control panel power output |
| 19 | SGND2 | Serial ground | GND | Serial port ground |
| 20 | TRxD3+ | RS-485 | I/O | Serial Port 3 RS-485 data+ |
| 21 | TRxD3- | RS-485 | I/O | Serial Port 3 RS-485 data− |
| 22 | GND | GND | GND | Ground reference |

**Table 1010.  KGX Interface - Pinout (Cont)**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|-----------|-----|-------------|
| J1 - Power and I/O Connector (DB-44) | | | | |
| 23 | 232 RxD3 | RS-232 | I | Serial Port 3 RS-232 data in (not used with KGX control panel) |
| 24 | 232 TxD3 | RS-232 | O | Serial Port 3 RS-232 data out (not used with KGX control panel) |
| 25 | 232 RxD4 | RS-232 | I | Serial Port 4 RS-232 data in |
| 26 | 232 RxD5 | RS-232 | I | Serial Port 5 RS-232 data in |
| 27 | AIR/GND | Open/ground | I | Air/ground in (squat switch - configurable) |
| 28 | TX SUPPRESS | Vin -1.5 volts | O | L-band suppression bus |
| 29 | Reserved | N/A | - | N/A |
| 30 | GND | Ground | GND | Personality module power return |
| 31 | RTRN | Ground | GND | Aircraft power return |
| 32 | REM ON | Open/ground | I | Remote power control (Ground: ON, Open: OFF) |
| 33 | 232 TxD2 | RS-232 | O | Serial Port 2 RS-232 data out |
| 34 | 429 IN 1B | ARINC 429 | I | ARINC 429 input Port 1B |
| 35 | 429 IN 1A | ARINC 429 | I | ARINC 429 input Port 1A |
| 36 | 429 IN 2B | ARINC 429 | I | ARINC 429 input Port 2B |
| 37 | RxD6+ | RS-422 | I | Serial Port 6 data in+ |
| 38 | RxD6- [1] | RS-422/RS-232 | I | Serial Port 6 data in- |
| 39 | PPS IO+ | ARINC 743 A/B | I/O | Internal/external GPS pulse each second out/in+ |
| 40 | PPS IO- | ARINC 743 A/B | I/O | Internal/external GPS pulse each second out/in- |
| 41 | UAT STATUS | Open/ground | O | ADS-B status |
| 42 | 232TxD5 | RS-232 | O | Serial Port 5 RS data out |
| 43 | CLK_PM | I2C | I | Personality module clock |
| 44 | DATA_PM | I2C | I/O | Personality module data |

**NOTE:**

  **1**     Serial Port 6 can be optionally configured for RS-232 serial interface on Pins J1-8 and J1-38.

## 10. KGX Interface Details (All Models)

### A. Power Input

(1) Aircraft power is provided to the KGX through the J1 power and I/O connector. The power supply input can be 10 to 40 VDC. Use a 2-AMP circuit breaker for power supply protection. Power input resides on the pins shown in Table 1011.

**Table 1011. Power Input**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|------------|-----|-------------|
| J1-1 | Vin | 10 to 40 VDC | Pwr | Aircraft power input |
| J1-16 | Vin | 10 to 40 VDC | Pwr | Aircraft power input |
| J1-17 | RTRN | Ground | GND | Aircraft power return |
| J1-31 | RTRN | Ground | GND | Aircraft power return |
| J1-32 | REM ON [1] | Open/ground | I | Remote power control (Ground: ON, Open: OFF) |

**NOTE:**

**1** REM ON must be tied to KGX control panel Pin 7 for remote on/off control or tied to ground for the KGX to power up.

### B. Personality Module

NOTE: The personality module is installed to simplify KGX service replacement.

(1) The PM eliminates the need to reconfigure the KGX if replaced with a new unit for any reason after initial configuration. Installation specific configuration data is stored in the PM as well as in the KGX. The installation configuration data in the PM (if present) is copied to the KGX at power-up.

(2) Both the PM and the KGX configuration data are stored during the installation configuration process. The PM is optional but simplifies the process to replace a serviced KGX. Refer to Paragraph 13 in this section for the detailed installation of the PM.

(3) The KGX control panel (if used in the installation) also contains a back-up copy of the installation configuration data. If the PM is not installed, the KGX control panel will automatically reconfigure the KGX if it is replaced in the installation.

(4) However, if the KGX control panel is replaced in an installation without the PM, the KGX must be reconfigured.

(5) The PM connections are on the pins shown in Table 1012.

**Table 1012. Personality Module Interface**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|------------|-----|-------------|
| J1-14 | Vpm | 3.0 to 3.6 VDC | O | Personality module power output |
| J1-30 | GND | Ground | GND | Personality module power return |

**Table 1012.  Personality Module Interface (Cont)**

| Pin | Signal | Electrical | I/O | Description |
|---|---|---|---|---|
| J1-43 | CLK_PM | I2C | O | Personality module clock |
| J1-44 | DATA_PM | I2C | I/O | Personality module data |

**NOTE:**

**1**    The PM has no lightning protection so the wire length between the PM and the power and I/O connector must be less than 4 inches (101.6 mm).

### C.  Status LEDs

(1)  Four external LEDs on the front of the enclosure indicate general system status to the installer. Table 1013 describes the LED states that can be observed.

**Table 1013.  LED States**

| Name | Description |
|---|---|
| Status | UAT system status (RED) |
| | ON    UAT failure, troubleshoot system |
| | OFF    UAT is operating normally |
| | Flash fast    GPS fault condition or no position available |
| GPS | GPS status (GREEN) |
| | Flash slow    GPS is acquiring satellites and determining position |
| | Flash fast    GPS reporting a fault condition |
| | ON    GPS has acquired satellites and is operating normally |
| | OFF    GPS is not communicating |
| TX | UAT transmit (GREEN) |
| | Blink ON    Blinks ON when ADS-B data is transmitted (once each second) |
| | OFF    No UAT transmissions |
| Rx | UAT receive (GREEN) |
| | Blink ON    Blinks on when ADS-B data is received |
| | OFF    No UAT receptions |

### D.  KGX Control Panel Power

(1)  System ON/OFF power is remotely controlled using the REM ON pin (J1-32). The system will power on when REM ON is grounded and power off when REM ON is open.

(2)  The KGX control panel uses the following KGX interfaces when installed:

- System ON/OFF remote power control, REM ON (J1-32)

- Low voltage +7 VDC power (J1-18 & J1-2)

- Serial Port 3 RS-485 communication (J1-20 & J1-28).

NOTE: The KGX control panel uses Serial Port 3 so when it is installed, the Serial Port 3 RS-232 pins (J1-23 & J1-24) must not be connected to other equipment (Display, etc.)

NOTE: The REM ON pin (J1-32) MUST be connected to ground when not using remote power control or a KGX control panel is not installed for the system to power on.

(3) The KGX control panel interface connections are shown in Table 1014.

**Table 1014.  Control Panel Interface**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|-----------|-----|-------------|
| J1-2 | GND | Ground | GND | KGX control panel power return |
| J1-18 | Vcp | +7 VDC | O | KGX control panel power output |
| J1-32 | REM ON | Open/ground | I | Remote power control (Ground: ON, Open: OFF) |
| J1-20 | TRxD3+ | RS-485 | I/O | Serial Port 3 RS-485 data+ |
| J1-21 | TRxD3− | RS-485 | I/O | Serial Port 3 RS-485 data- |

**E. Configurable Serial Interfaces**

(1) There are nine configurable serial interfaces available on the KGX:

- Six UART style serial port interfaces (Ports 1, 2, 3, 4, 5 and 6)

- Two ARINC 429 input interfaces (429 IN1 and 429 IN2)

- One ARINC 429 output interface (429 OUT1).

NOTE: Refer to Paragraph 3.C. in the CONFIGURATION, CALIBRATION, AND CHECKOUT section for detailed serial and ARINC port configuration information.

(2) Serial Port- RS-232/RS-422

(a) Four UART style (serial port) serial interfaces are available on the KGX:

- Serial Port 1 - RS-232 transmit and receive capability

- Serial Port 2 - RS-232 transmit and receive capability

- Serial Port 3 - RS-232 transmit and receive capability

- Serial Port 4 - RS-232 receive-only capability

- Serial Port 5 - RS-232 transmit and receive capability

- Serial Port 6 - RS-232 or RS-422 bidirectional (transmit and receive) capability.

NOTE: Serial Port 6 can be optionally configured for RS-232 serial interface on Pins J1-8 and J1-38.

(b) The Serial ports can be software configured for various protocols and baud rates.

(c) The UART style serial interface pin connections are shown in Table 1015.

NOTE: Refer to Paragraph 3.C. in the CONFIGURATION, CALIBRATION, AND CHECKOUT section for detailed serial and ARINC port configuration information.

**Table 1015.  Serial Ports**

| Pin | Signal | Electrical | I/O | Description |
|---|---|---|---|---|
| J1-4 | 232 RxD1 | RS-232 | I | Serial Port1 RS-232 data in |
| J1-5 | 232 TxD1 | RS-232 | O | Serial Port 1 RS-232 data out |
| J1-3 | 232 RxD2 | RS-232 | I | Serial Port 2 RS-232 data in |
| J1-33 | 232 TxD2 | RS-232 | O | Serial Port 2 RS-232 data out |
| J1-23 | 232 RxD3 | RS-232 | I | Serial Port 3 RS-232 data in |
| J1-24 | 232 TxD3 | RS-232 | O | Serial Port 3 RS-232 data out |
| J1-19 | SGND2 | Serial ground | GND | Serial ground |
| J1-25 | 232 RxD4 | RS-232 | I | Serial Port 4 RS-232 data in |
| J1-26 | 232 RxD5 | RS-232 | I | Serial Port 5 RS-232 data in |
| J1-42 | 232 TxD5 | RS-232 | O | Serial Port 5 RS-232 data out |
| J1-9 | SGND4 | Serial ground | GND | Serial ground |
| J1-7 | TxD6+ | RS-422 | O | Serial Port 6 data out+ |
| J1-8 | TxD6- [1] | RS-422/RS-232 | O | Serial Port 6 data out- |
| J1-37 | RxD6+ | RS-422 | I | Serial Port 6 data in+ |
| J1-38 | RxD6- [1] | RS-422/RS-232 | I | Serial Port 6 data in- |

**NOTE:**

  1    Serial Port 6 can be optionally configured for RS-232 serial interface on Pins J1-8 and J1-38.

(3)   ARINC 429 Ports

(a)   Two ARINC 429 input serial interfaces are available on the KGX. The ARINC 429 input ports are 429 IN 1 and 429 IN 2. The KGX has one ARINC 429 output which is 429 OUT 1. The ARINC ports can be software configured for various label interfaces and as either high-speed or low-speed.

(b)   The ARINC 429 serial interface pin connections are shown in Table 1016.

NOTE:    Refer to Paragraph 3.C. in the CONFIGURATION, CALIBRATION, AND CHECKOUT section for detailed serial and ARINC port configuration information.

**Table 1016.  ARINC 429 Ports**

| Pin | Signal | Electrical | I/O | Description |
|---|---|---|---|---|
| J1-6 | 429 IN 2A | ARINC 429 | I | ARINC 429 input Port 2A |
| J1-10 | 429 OUT 1A | ARINC 429 | O | ARINC 429 output Port 1A |
| J1-11 | 429 OUT 1B | ARINC 429 | O | ARINC 429 output Port 1B |
| J1-34 | 429 IN 1B | ARINC 429 | I | ARINC 429 input Port 1B |

**Table 1016. ARINC 429 Ports (Cont)**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|------------|-----|-------------|
| J1-35 | 429 IN 1A | ARINC 429 | I | ARINC 429 input Port 1A |
| J1-36 | 429 IN 2B | ARINC 429 | I | ARINC 429 input Port 2B |

**F.   Discrete Inputs**

(1)   Three discrete inputs are available to supply control inputs to the UAT. Discrete input connection pins are shown in Table 1017.

NOTE:   Input pins are pre-configured active low. Refer to SYSTEM INTERCONNECT DIAGRAMS, Figure 2011 thru Figure 3014 for a wiring diagram reference.

**Table 1017. Discrete Inputs**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|------------|-----|-------------|
| J1-15 | TRAF TEST | Open/ground | I | Traffic test |
| J1-27 | AIR/GRND | Open/ground | I | Air/ground in (squat switch - configurable) |
| J1-12 | ANONYMOUS MODE | Open/ground | I | Anonymous mode |

(2)   Air/Ground Input

NOTE:   Automatic air/ground determination is required for transceiver and transmitter installations.

(a)   The air/ground discrete input connects to an open/ground squat switch or other air/ground discrete indication. The air/ground discrete is configurable to be either:

• Not connected

• High when airborne

• Low (ground) when airborne

(b)   Deleted.

(c)   Airborne or on ground status affects ADS-B message transmission behavior.

(d)   Light Aircraft Installations: The KGX automatically determines the air/ground status if configured to the light aircraft (<15500 lbs) emitter category (refer to CONFIGURATION, CALIBRATION, AND CHECKOUT, Paragraph 4.E. Step (9) and Paragraph 5.C. (5)) without the use of the external air/ground input discrete.

(e)   Other Aircraft Installations: The KGX validates the air/ground status of the external air/ground input for all other Emitter Categories including Rotorcraft utilizing available GPS and air (pressure altitude, airspeed, etc.) data.

(f)   Rotorcraft Installations: The KGX sufficiently validates an air/ground input discrete based on collective position or collective position combined with oil pressure, no/low engine RPM, airspeed, etc. to ensure false On Ground indications are not transmitted during auto-rotation training and other unusual conditions

(3)   Traffic Test Input

(a)   The traffic test input indicates the traffic test status of a 429 traffic display. The KGX will send traffic test data to ARINC OUT 1 when the traffic test input is active.

(4)   Anonymous Mode Input

(a)   The anonymous mode allows the KGX to broadcast a self-assigned random temporary address and no call sign when enabled. A dedicated pilot interface is required to provide this input.

(b)   The anonymous mode cannot be used on:

• Aircraft equipped with a Mode S transponder.

• Aircraft with dual link 1090ES and UAT ADS-B out systems operating at the same time.

(c)   The anonymous mode is not active:

• During the first 90 seconds after the KGX powers on.

• When the squawk code is set to anything other than 1200.

### G.   Discrete Outputs

(1)   Two discrete outputs are available to supply UAT status and operational information to other equipment. The two discrete output connection pins are shown in Table 1018.

**Table 1018.  Discrete Outputs**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|-----------|-----|-------------|
| J1-28 | TX SUPPRESS | Vin - 1.5 volts | O | L-band suppression bus |
| J1-41 | UAT STATUS | Open/ground | O | ADS-B status |

(2)   UAT Status Output

(a)   The UAT status output is an active low, open collector output capable of sinking a maximum of 100 mA. The UAT status output indicates a UAT transmit or receive system failure when continuously grounded. UAT status output also indicates the loss of valid GPS data from an internal or external GPS.

(b)   If the internal or external GPS is not functioning, reporting a failure, or reporting invalid GPS position data, this discrete will toggle between ground and open at a rate of approximately four times each second.

NOTE:   Failure status of the UAT as well as loss of UAT position data must be annunciated to the pilot. The connected display (or KGX control panel) typically provides annunciation. This discrete can be used to drive an annunciator when a display or KGX control panel is not installed or capable of displaying status.

### H.   TX Suppression Output

(1)   The TX suppress output is for suppressing other L-band equipment during UAT transmissions. TX suppress outputs a high (Vin - 1.5 volts) only during UAT ADS-B message transmissions and is low otherwise. The TX suppress output is typically connected to the transponder suppression bus.

NOTE:   Receiver only installations do not need to connect to the transponder suppression bus.

### I. Time Mark I/O (PPS)

(1) The time mark I/O is an RS-422 differential pair conforming to the ARINC 743 A/B specification for the one PPS input from an external GPS or output when the KGX has an internal GPS. The time mark I/O from a GPS provides the timing synchronization for sending ADS-B messages.

> NOTE: The time mark from a GPS provides timing synchronization for ADS-B transmit messages. The time mark from an external GPS must be synchronized to UTC second epoch to operate correctly with the KGX.

> NOTE: Time mark inputs from a single ended PPS source (i.e., GPS) must be properly interfaced to the differential interface for reliable operation.

(2) The time mark input/output pin connections are shown in Table 1019.

**Table 1019. Time Mark Input**

| Pin | Signal | Electrical | I/O | Description |
|------|---------|-------------|------|-------------|
| J1-39 | PPS IO+ | ARINC 743 A/B | I/O | Internal/external GPS PPS out/in+ |
| J1-40 | PPS IO- | ARINC 743 A/B | I/O | Internal/external GPS PPS out/in- |

### J. Maintenance Port Interface

(1) The MPI can be used to configure the system, supply installation status information, and update system software/firmware. The MPI must be used by qualified installation personnel to configure and update the system.

(2) The MPI functionality is provided through serial Port 3 or serial Port 5 (preferred) on the KGX series DB-44 connector. A female DB-9 connector can be mounted in the aircraft for convenient MPI access to a standard RS-232 interface meeting the specifications of TIA/EIA-232-F, Interface Between DTE and DCE Employing Serial Binary Data Interchange.

(3) If both Port 3 and Port 5 are configured and connected to other aircraft equipment, the MPI can still be accessed if the configured device is not actively connected. Therefore, an inline connector can be installed between the devices and used to temporarily disconnect the configured device and permit external MPI access.

(4) Figure 1005 shows an example of Port 5 connecting to a standard female DB-9 (DE-9F) RS-232 connector as an inline connection or dedicated MPI port. This allows any other standard RS-232 device to communicate with the KGX.
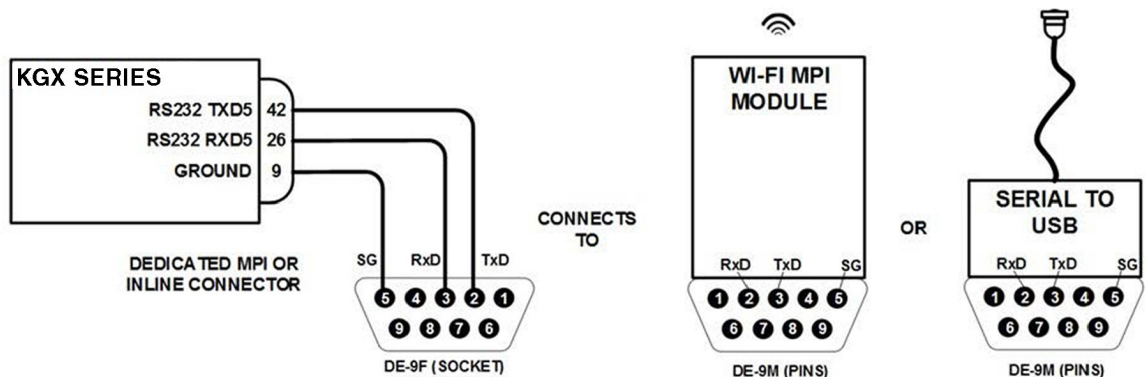


**Figure 1005. (Sheet 1 of 1) Inline MPI Connector and Compatible MPI Devices**

(5) The MPI connector can be mated to an off-the-shelf RS-232 to USB converter for configuration and troubleshooting. Refer to CONFIGURATION, CALIBRATION, AND CHECKOUT, Section 6, for more information on configuring the KGX through the MPI. (6)

(6) Table 1020 shows the MPI DE-9F connections to Port 3 or Port 5 on the KGX.

**Table 1020. MPI Pinout**

| FEMALE DB-9 | | PORT 5 (DB-44) | | PORT 3 (DB-44) | |
|---|---|---|---|---|---|
| PIN | SIGNAL | PIN | SIGNAL | PIN | SIGNAL |
| 2 | Tx | J1-42 | 232 TxD5 | J1-24 | 232 TxD3 |
| 3 | Rx | J1-26 | 232 RxD5 | J1-23 | 232 RxD3 |
| 5 | GND | J1-9 | SGND4 | J1-19 | SGND2 |

(7) The female DB-9 connector can be connected to a PC using an off-the-shelf RS-232 to USB converter.

(8) The KGX also has a USB micro-AB connector which provides an alternate serial Port 5 connection, but is not recommended for use.

(9) Alternatively, a KGX WiFi module (PN 89000016-002) can be connected to Port 3 or Port 5. The MPI functionality can then be accessed wirelessly using the ADS-B MPI application.

NOTE: When Port 3 and Port 5 are configured and interfaced to other equipment (KGX control panel or display), the connections to the configured device must be temporarily disconnected to use the port for MPI purposes. If the KGX control panel is disconnected, the Remote On pin (J1-32 on the KGX) must be grounded to turn on the KGX.

(10) Refer to CONFIGURATION, CALIBRATION, AND CHECKOUT for more information on MPI usage, installation configuration, and troubleshooting.

## 11. KGX Control Panel Electrical Connections

### A. KGX Control Panel Connection - Pinout

(1) The connection from the KGX 150/130 transceivers and receivers to the KGX control panel uses a minimum of six signal lines:

- TMAP pair
- Power and Ground pair
- Remote On discrete line plus associated ground line.

(2) Refer to Table 1021 for the KGX control panel connections (DB-9).

**Table 1021. KGX Control Panel Connections (DB-9)**

| Pin | Signal | Electrical | I/O | Description |
|---|---|---|---|---|
| 1 | GND | Ground | GND | Signal common |
| 2 | TMAPA | RS-485 | I/O | KGX control panel serial bus (+) |
| 3 | TMAPB | RS-485 | I/O | KGX control panel serial bus (-) |
| 4 | ALT_OUT | RS-232 | O | Pressure altitude out |
| 5 | Reserved | - | - | - |

**Table 1021. KGX Control Panel Connections (DB-9) (Cont)**

| Pin | Signal | Electrical | I/O | Description |
|-----|--------|------------|-----|-------------|
| 6 | GND | Ground | GND | Signal common |
| 7 | REM ON | Open/GND | O | Remote power control (Ground: ON, Open: OFF) |
| 8 | POWER | 6 to 10 VDC | Pwr | KGX control panel power |
| 9 | GND | Ground | GND | KGX control panel power common |

## 12. KGX Control Panel Interface Details

### A. Power

CAUTION:     DO NOT CONNECT TO AIRCRAFT INPUT POWER.

(1)   The KGX control panel uses 5.5 to 10 volts from the KGX (typically approximately 7 volts).

### B. Remote ON

(1)   The remote ON output controls the power to the KGX. This is connected to the KGX REM ON input (J1-32) to remotely control power to both units.

### C. TMAP Bus

(1)   TMAP is a proprietary protocol using RS-485 bi-directional serial bus between the KGX control panel and KGX. The KGX control panel RS-485 lines (TMAPA and TMAPB) are connected to the KGX RS-485 lines (TRxD3+ and TRxD3-) respectively.

### D. Altitude Out

(1)   The KGX control panel outputs pressure altitude data on an RS-232 serial output pin (ALT_OUT) at 9600 baud using the Icarus format (refer to SERIAL INTERFACE SPECIFICATIONS, Paragraph 2). The pressure altitude data output depends on the altitude input configuration.

(2)   If the KGX is configured with an altitude/air data input (ARINC or serial port), then the KGX control panel will use the same data on Pin 4 (ALT_OUT).

(3)   If the KGX is not configured with an altitude/air data input, then the pressure output of the KGX control panel defaults to its built-in altitude encoder. If the built-in altitude encoder is used then it must feed the aircraft transponder so that the transponder and the KGX share the same altitude source.

**Table 1022. KGX to KGX Control Panel Connections**

| KGX (DB-44) | | KGX Control Panel (DB-9) | |
|-------------|--------|--------------------------|--------|
| Pin | Signal | Pin | Signal |
| J1-18 | Vcp | 8 | POWER |
| J1-2 | GND | 1,6,9 | GND |
| J1-32 | REM ON | 7 | REM ON |

**Table 1022.  KGX to KGX Control Panel Connections (Cont)**

| KGX (DB-44) | | KGX Control Panel (DB-9) | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| J1-20 | TRxD3+ | 2 | TMAPA |
| J1-21 | TRxD3- | 3 | TMAPB |

## 13.  Personality Module Installation

### A.    General

(1)   The personality module is intended to be installed inside the DB-44 connector backshell of the cable harness in the aircraft.  The personality module allows the KGX and, if installed, the KGX control panel to be removed and replaced without having to reconfigure the system.

(2)   The installation kit parts listed in Table 1023 from the KGX personality module installation kit, PN 89000016-006, are used to install the personality module in the backshell.

**Table 1023.  KGX Personality Module Installation Kit, PN 89000016-006**

| Qty | Description |
|---|---|
| 1 | Personality module |
| 4 | Pin contact, crimp AWG 24 to 28 |
| 1 | Double-sided adhesive tape |

(3)   Table 1024 shows the personality module wire color connections to the DB-44 connector.

**Table 1024.  Personality Module Interface**

| Pin | Signal | Electrical | I/O | Description | PM Wire Color |
|---|---|---|---|---|---|
| J1-14 | Vpm | 3.0 to 3.6 VDC | O | Personality module power | Red |
| J1-30 | GND | Ground | GND | Personality module power return | Black |
| J1-43 | CLK_PM | I2C | I | Personality module clock | Blue |
| J1-44 | DATA_PM | I2C | I/O | Personality module data | White |

(4)   The PM must be assembled into the backshell of the DB-44 male connector in the aircraft wiring harness as follows:

(a)   Strip 0.125 inch (3.18 mm) of the insulation from each of the four wires of the PM.

(b)   Crimp pin contacts onto each of the four wires of the PM.

(c)   Insert crimped pins into the DB-44 connector housing in accordance with Table 1024.

(d)   Adhere one side of the double-sided tape pad to the PM as shown in Figure 1006 and the other side must be adhered to one side of the connector backshell as the connector and backshell are assembled together.

ID-495089
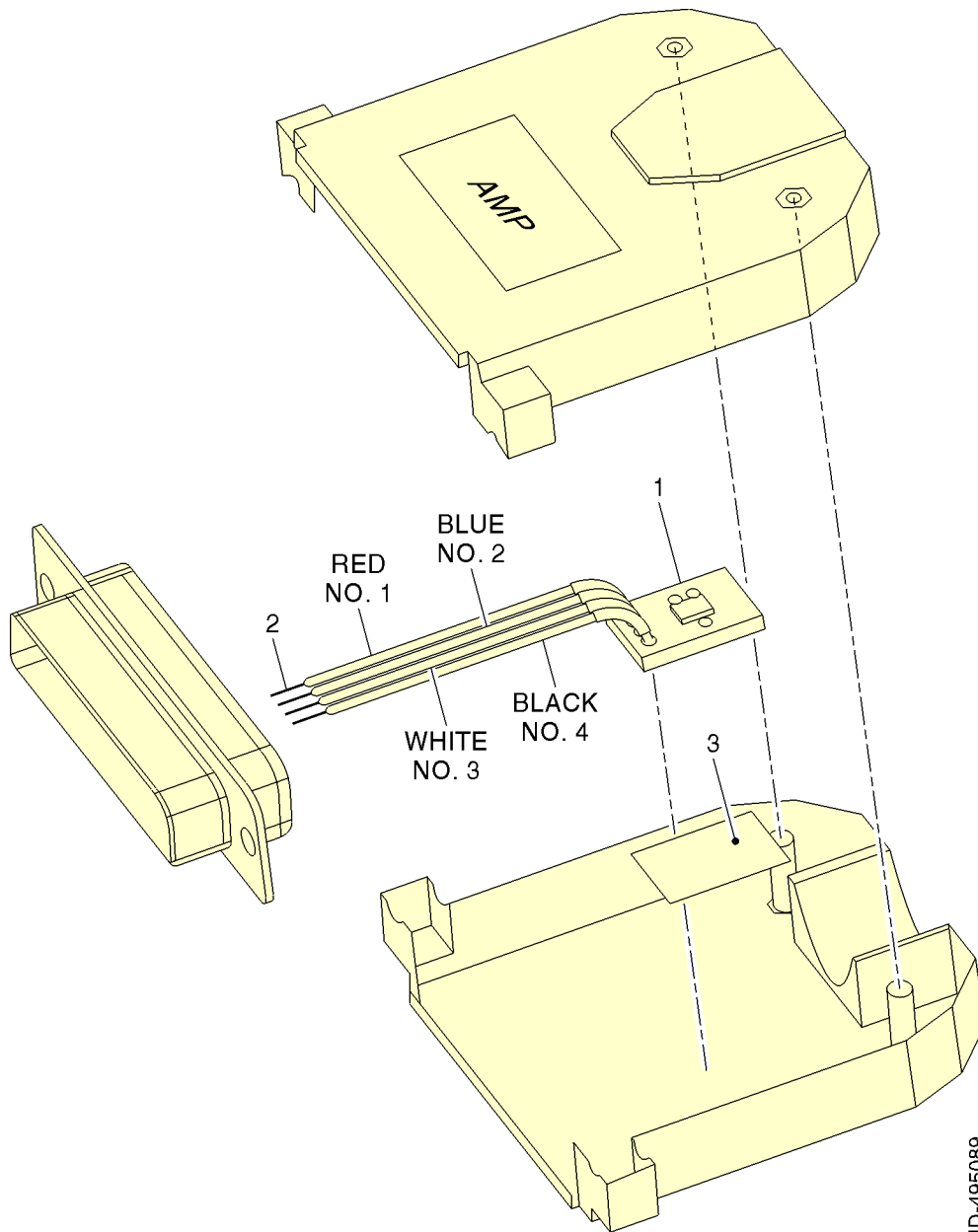
**Figure 1006. (Sheet 1 of 1) PM Assembly**

## 14. UAT Antenna Installation

### A. General

(1) The antenna must be installed according to the manufacturer's instructions. Selecting appropriate UAT antenna locations is critical to the correct performance of the KGX. The following considerations must be taken into account when selecting the antenna location.

    (a) The antennas must be installed away from any projections, the engine(s) and propeller(s). It must also be installed away from landing gear doors, access doors, or other openings which will break the ground plane for the antenna.

(b)   The antenna must be mounted on the bottom and/or top surface of the aircraft and in a vertical position when the aircraft is in level flight.

(c)   Avoid mounting the antenna within 3 feet (91.44 cm) of the ADF sense antenna or any COMM antenna and 6 feet (182.88 cm) from the transponder and DME antennas.

(d)   In installations without a digital serial interface to the transponder, the KGX contains a Mode A receiver to receive Mode A/C transponder control data from the transponder antenna through the UAT antennas. The transponder antenna must be located on the bottom of the aircraft (same as the UAT antenna).

   1   The transponder antenna is recommended to be at least 6 feet (182.88 cm) and no further than 12 feet (365.8 cm) away from the UAT antenna.

   2   The transponder antenna can be as close as 3 feet (91.44 cm) if there is at least 2-3 dB of UAT antenna cable loss.

   3   There must be a clear line-of-sight between the UAT antenna and the transponder antenna with no obstructions or projections.

(e)   Where practical, plan the antenna location to keep the cable lengths as short as possible and avoid sharp bends in the cable to minimize the VSWR.

(2)   Electrical connection to the antenna must be protected to avoid loss of efficiency as a result of the presence of liquids or moisture. All antenna feeders must be installed in such a way that a minimum of RF energy is radiated inside the aircraft.

B.   **UAT Antenna Ground Plane**

(1)   When a conventional aircraft monopole antenna is used it relies on a ground plane for correct operation. For ideal performance the ground plane must be very large compared to the wavelength of the transmission, which is approximately 12 inches (304.8 mm).

(2)   For a composite or fabric skinned aircraft, a metallic ground plane must be fabricated and fitted under the antenna.

(3)   As the ground plane is made smaller, the actual dimensions of the ground plane become more critical, and small multiples of the wavelength must be avoided. A circular ground plane must be avoided. Rectangles or squares are much less likely to create a critical dimension that resonates with the transmissions. The smallest practical ground plane is a square around 5.25 inches (133.35 mm) for each side.

(4)   As the size increases the performance can actually get worse, but will be better by the time the ground plane is 30.5 inches (774.7 mm) on each side. Anything much larger than that size is unlikely to show significant further improvement.

(5)   The thickness of the material used to construct the ground plane is not critical, provided it is sufficiently conductive. A variety of proprietary mesh and grid solutions are available.

C.   **UAT Antenna Cable**

(1)   The KGX is designed to meet Class A1H/A1S requirements with an allowance of 2 to 6 dB for loss in the connectors and cable used to connect it to the antenna.

(2)   Excessive loss degrades transmitter output power so it is recommended that the installation cable loss be limited to the loss minimum of 2 to 5.5 dB.

(3)   Allowing 0.25 dB loss for the connector at each end of the antenna cable assembly leaves an allowance of 1.5 to 5.0 dB loss for the cable itself.

(4)   An acceptable cable then has:

•   A minimum of 1.5 dB loss for the run length but no more than 5.0 dB loss

- A characteristic impedance of 50 ohms

- Double braid screens or has a foil and braid screen.

(5)   Once the cable run length is determined, a cable type with the correct attenuation (loss) for each foot that meets the above requirements can be chosen. Longer runs require lower loss cable. Consider moving the KGX closer to the antenna to minimize the losses in the antenna cable subject to the limits identified above.

(6)   Table 1025 is a guide to the minimum and maximum usable lengths of some common cable types. Actual cable loss varies between manufacturers and Table 1025 is based on typical data.

(7)   Use Table 1025 as a guide only and refer to the manufacturer's data sheet for the specific cable chosen to calculate the minimum and maximum lengths.

**Table 1025.  Common Cable Types**

| Cable | Attenuation (dB/100 feet (30.5 m) at 1 GHz) | MIN Length feet (m) | MAX Length feet (m) |
|---|---|---|---|
| RG-142 | 12.8 | 11.7 (3.56) | 39.1 (11.92) |
| RG-174 | 27.1 | 5.5 (1.67) | 18.5 (5.64) |
| RG-316 | 25.8 | 5.8 (1.76) | 19.4 (5.91) |
| RG-393 | 7.5 | 20 (6.09) | 66.7 (20.33) |
| RG-400 | 14.5 | 10.3 (1.34) | 34.5 (10.52) |

(8)   When routing the cable, make sure of the following:

- Route the cable away from heat sources.

- Route the cable away from away from potential interference sources such as ignition wiring, 400-Hz generators, fluorescent lighting, and electric motors

- Allow a minimum separation of 12 inches (300 mm) from an ADF antenna cable

- Keep the cable run as short as possible

- Avoid routing the cable around tight bends

- Avoid kinking the cable even temporarily during installation

- Secure the cable so that it cannot interfere with other systems.

## 15.  GPS Antenna Installation (KGX 150 Series Only)

### A.   General

(1)   The antenna must be installed according to the manufacturer's instructions. Selecting appropriate GPS antenna locations is critical to the correct performance of the KGX 150 series. The following considerations must be taken into account when selecting the antenna location.

(a)   Typically, a GNSS antenna is located forward or aft of the wings on top of the fuselage.

(b)   GNSS antennas must be installed to give the widest, unobstructed view of GNSS satellites.

NOTE:   Shadowing by aircraft structure (and in some cases by rotorcraft blades) can adversely affect operation of the GNSS equipment.

(c)   Antenna placement on the airframe must be optimized to make sure that the sensor can take full advantage of a 5 degree mask angle. This includes consideration of antenna

location with respect to blockage from all aircraft components at typical level cruising attitude, as well as minimizing the effects of aircraft shadowing during typical maneuvers.

(d)  The antenna must be separated as much as practical from transmitting antennas. For small aircraft, the antenna also must be separated as much as practical from the windscreen to prevent case-to-antenna coupling.

(e)  For installations on rotorcraft, the effects of the rotor blades on antenna performance must be considered. This can require additional equipment functional flight evaluation or analytical evaluation to confirm the suitability of antenna location.

(f)  For multiple-sensor installations, the installer must reduce the likelihood that a single lightning strike affects all the sensors.

**B.  Antenna Power**

(1)  The internal GPS of the KGX 150 series utilizes an active antenna which means the antenna includes a low noise amplifier. The power for the low noise amplifier is provided from the GPS receiver through the antenna coax cable. No other installation considerations are necessary.

**C.  Recommended Cable**

(1)  RG400 or RG142 cable with a maximum length of 50 feet (15.24 m) is recommended. The cable including connectors, loss must not exceed 10 dB. For antennas mentioned in Paragraph 4.B. , RG400 or RG142 cable with a maximum length of 25 feet (7.62 m) is recommended. The cable including connectors, loss must not exceed 5 dB.

**D.  SATCOM Compatibility**

(1)  The KGX 150 series internal GPS/WAAS sensor has been shown through testing to be specification compliant for single-channel SATCOM compatibility in accordance with RTCA DO-229D.

(2)  Extra care must be exercised when installing GNSS equipment on aircraft with SATCOM having multiple channels, as cautioned in Section 14-1 of AC 20-138B: "GNSS equipment is particularly susceptible to out-of-band SATCOM emissions and in-band inter-modulation between multiple channel SATCOM installations. GNSS equipment must not be installed in aircraft with multiple SATCOM channels unless the simultaneous use of interfering frequencies can either be prevented or demonstrated not to interfere with the operation of the GNSS equipment."

## 16.  KGX Control Panel Static Pressure Connection

**A.  General**

(1)  The KGX control panel includes an altitude encoder which must be connected to the same source of static pressure as the primary altimeter on the aircraft if this sensor is utilized in the installation. The KGX control panel static pressure port provides a mounting spigot intended for nominal 0.2 inch (5 mm) or 3/16-inch (4.8-mm) inside diameter tubing. A 0.2 inch (5 mm) EPDM rubber tubing is included in the installation kit to facilitate connection to the aircraft static system.

(2)  Choose a point in the existing static pressure line that is as close as practical to the KGX control panel. Cut the static pressure line, and use the supplied T-fitting to connect the altitude encoder. Take care not to contaminate the inside of the static line when cutting or inserting the connectors.

(3)  Figure 1007 shows the general arrangement, although other combinations can be used.
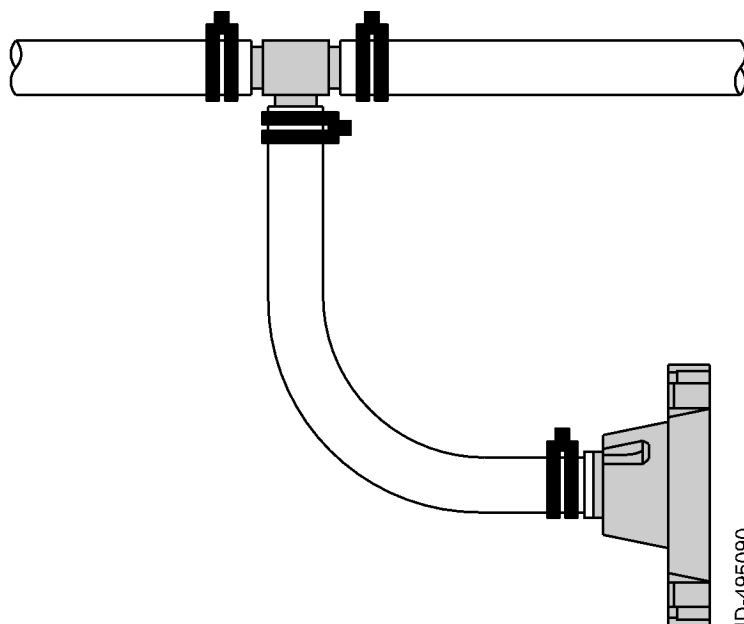
**Figure 1007. (Sheet 1 of 1) KGX Control Panel Static Pressure Connection**

(4)   For aircraft with 1/4-inch (6.3-mm) static lines, two adapters are provided which can convert from 1/4-inch (6.3-mm) inside diameter hoses to the 0.2-inch (5-mm) hose in the install kit.

(5)   In all cases, the static line must include drainage provisions and must be routed in accordance with CS 23.1325 or other applicable airworthiness provisions for the aircraft.

## 17.  Equipment Limitations

### A.  General

(1)   The CDTIs integrated with this article must be analyzed for latency. This article ownship and traffic total latency is less than 1.25 seconds and the uncompensated latency is 0 seconds from current UTC second (not including serial data transmission time).

(2)   The antenna installation must comply with the specifications in Paragraph 14 for UAT antennas and Paragraph 15 for GPS antennas.

(3)   For a compliant installation in accordance with the TSO and the FAR, the KGX installation must meet the following requirements.

NOTE:   Certified installations must be approved by a STC or a TC.

### B.  TSO-C145c (KGX 150 Series Only)

(1)   "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 or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements."

### C.  TSO-C154c

(1)   "This article meets the minimum performance and quality control standards required by a technical standard order (TSO). If you are installing this article on or in a specific type or class of aircraft, you must obtain separate approval for installation."

      **D.**   **TSO-C157a**

         (1)   "This article meets the minimum performance and quality control standards required by a standard technical order (TSO). Installation of this article requires separate approval."

      **E.**   **TSO-C195a**

         (1)   "This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval."

      **F.**   **Non-TSO Functions**

         (1)   The KGX does not contain any functions outside the scope of the above TSO certifications.

## 18.  Department of Commerce Compliance

      **A.**   **General**

         (1)   The Department of Commerce/Bureau of Export Administration's "Revision of the Commodity Control List" permits shipment of commercial GPS products for General Destination (G-Dest) export only if they contain certain software provisions. To comply with the G-Dest category, the KGX 150 series with an internal GPS operates neither at altitudes above 60,000 feet (18,287 meters) MSL, nor at velocities more than 513 m/sec (about 1,000 knots). If either condition is detected, the GPS discontinues outputting signals and position data on its RS-232 port.

## SYSTEM INTERCONNECT DIAGRAMS

**1.   Typical System Configurations**

    **A.   General**

        (1)   This section contains general system interconnect and wiring diagram examples for popular configurations. Each system interconnect contains a table of appropriate KGX settings.

        (2)   The air/ground input varies on each aircraft depending on the equipment installed. Refer to the aircraft manual to determine the appropriate input signal to the KGX. Light Aircraft can refer to INSTALLATION, Paragraph 10.F. Step (2) for additional data about air/ground.

        (3)   All ports (except MPI) not connected to equipment should be set to UNUSED.

        NOTE:   The graphics that follow show system configuration from the Terminal MPI. For corresponding KGX control panel or ADS-B MPI App settings, refer to CONFIGURATION, CALIBRATION, AND CHECKOUT, and Paragraph 6.

        NOTE:   Highlighted configuration options represent those that are unique to each aircraft. Configuration options must be configured appropriately in accordance with CONFIGURATION, CALIBRATION, AND CHECKOUT, Paragraph 5.C. and Paragraph 6.

**2.   System Interconnect Diagrams**

    **A.   General**

        (1)   Refer to Table 2001 for a list of the system interconnect diagrams.

**Table 2001.  System Interconnect Diagrams**

| System | Figure Number |
|---|---|
| Garmin GNS 430W/530W Display and GPS, GTX-330 Transponder | Figure 2001 |
| Chelton FlightLogic Display, GSL-71 Controller, No Transponder | Figure 2002 |
| Aspen Display and Control, GTX 327 Transponder | Figure 2003 |
| BendixKing KSN 765/770 Display and GPS, GTX-327 Transponder | Figure 2004 |
| Mode A/C Transponder, KGX control panel | Figure 2005 |
| Garmin GNS 480, SL-70 Transponder, TCAS | Figure 2006 |
| Garmin MX-20 Display and Control, No Transponder | Figure 2007 |
| Garmin GMX-200 Display, GTX-330 Transponder | Figure 2008 |

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## Garmin GNS 430W/530W Display and GPS, GTX-330 Transponder



**Figure 2001. (Sheet 1 of 1) Garmin GNS 430W/530W Display and GPS, GTX-330 Transponder Interconnect Diagram**

**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS. REFER TO TABLE 2004 IN THIS SECTION FOR THE APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. REFER TO REFER TO INSTALLATION, PARAGRAPH 9.F.(2) AIR/GROUND INPUT FOR DETAILS ON ROTORCRAFT INSTALLATIONS.

6. SYSTEM DESCRIPTION:

SQUAWK CODE, IDENT, AND MODE CONTROL ARE PROVIDED BY GTX-330 WITH KGX CONTROL PANEL AS BACKUP. FAULT ANNUNCIATION IS PROVIDED BY KGX CONTROL PANEL.
TRAFFIC DISPLAY ON GNS 400W/500W AND PERSONAL ELECTRONIC DEVICE.

### Garmin System Configuration Settings

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. ROTORCRAFT
Squat Mode................ low
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. GPS-ADSBPlus, 9600
Serial In  2.............. GTX-Remote, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. UNUSED, 115200
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. UNUSED, 9600 (RS-422)
Serial Out 6.............. UNUSED, 9600 (RS-422)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1.............. Traffic, high
```

ID-613119

## Chelton FlightLogic Display, GSL-71 Controller, No Transponder
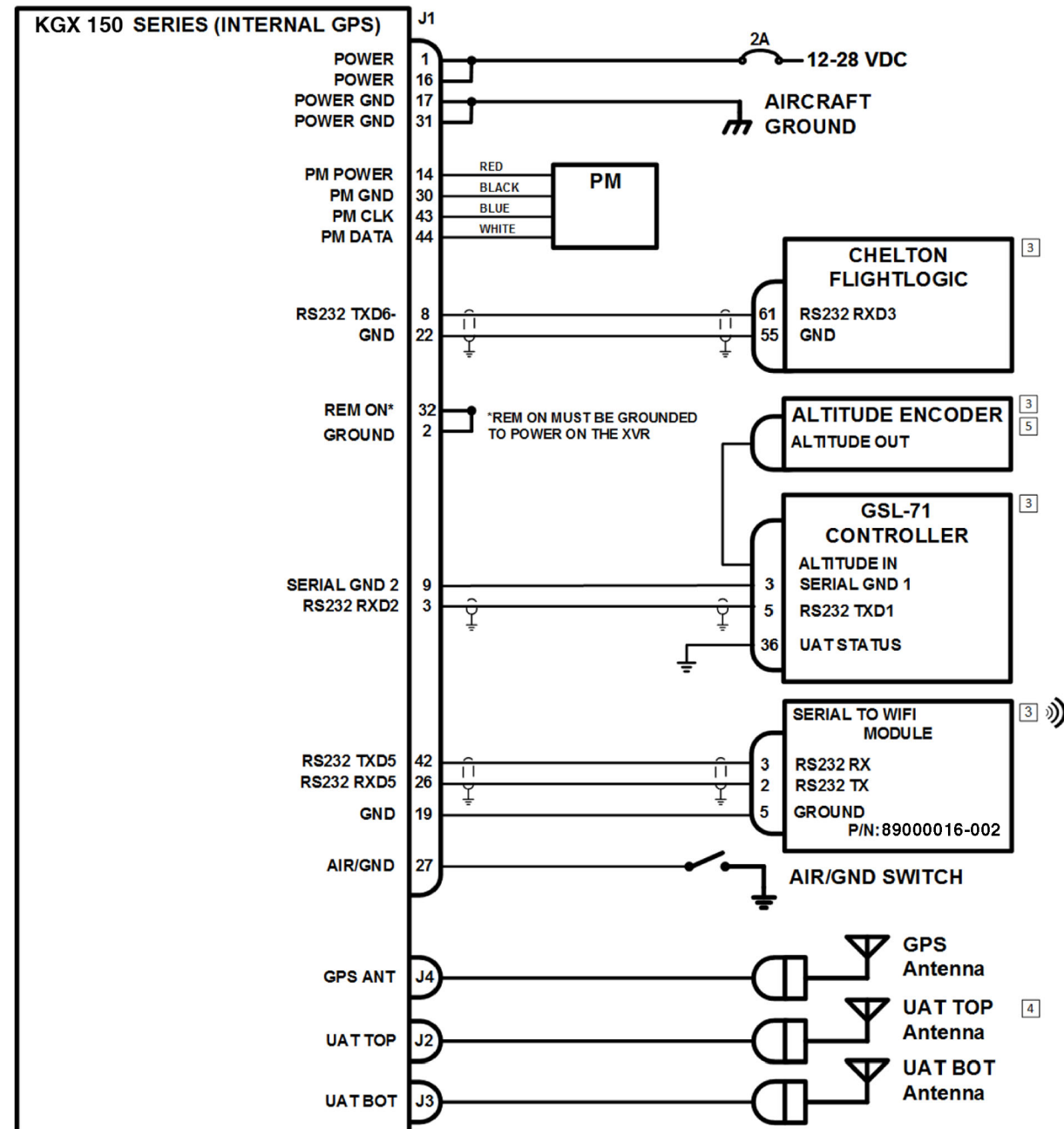


**Figure 2002. (Sheet 1 of 1) Chelton FlightLogic Display, GSL-71 Controller, No Transponder Interconnect Diagram**

### NOTES:

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL INSTALLATION MANUALS FOR EXTERNAL EQUIPMENT INTERCONNECTS. REFER TO TABLE 2004 IN THIS SECTION FOR THE APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. ALTITUDE SOURCE MUST PROVIDE DATA TO GSL-71 AT 9600 BAUD AND MINIMUM RESOLUTION OF 10 FEET.

6. SYSTEM DESCRIPTION:

    SQUAWK CODE, IDENT, MODE CONTROL ARE PROVIDED BY GSL-71.

    FAULT ANNUNCIATION PROVIDED BY CHELTON FLIGHTLOGIC

    TRAFFIC DISPLAY ON CHELTON FLIGHTLOGIC AND PERSONAL ELECTRONIC DEVICE.

**Chelton FlightLogic Display, GSL-71 Controller Settings**

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. SMALL AIRCRAFT
Squat Mode................ low
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ enable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. Internal-GPS, 19200
Serial In  2.............. GSL-71, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. UNUSED, 9600
Serial In  5.............. UNUSED, 115200
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. UNUSED, 38400 (RS-232)
Serial Out 6.............. Traffic-Alert, 38400 (RS-232)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1............... UNUSED, low
```

ID-613120
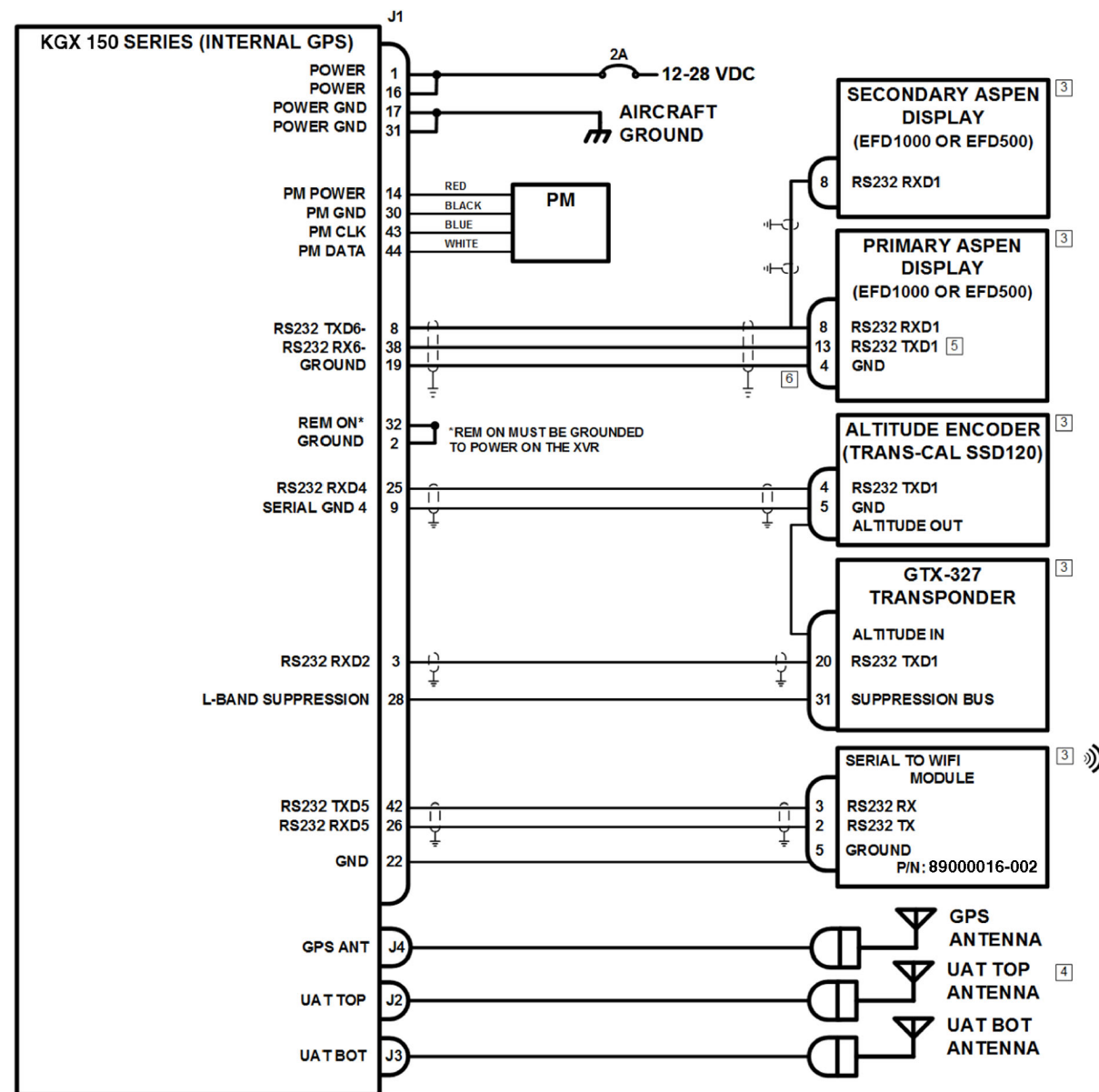
## Aspen Display and Control, GTX 327 Transponder



**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS. REFER TO TABLE 2004 IN THIS SECTION FOR THE APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. ONLY THE PRIMARY FLIGHT DISPLAY PIN 13 MAY BE CONNECTED TO THE KGX CONTROL PANEL. USE ONLY WHEN SEPARATE TRANSPONDER IS NOT INSTALLED.

6. GROUND CONNECTION SHOULD BE MADE TO EITHER THE ASPEN POWER GROUND PIN OR CASE GROUND.

7. SYSTEM DESCRIPTION:

   SQUAWK CODE, IDENT, MODE CONTROL ARE PROVIDED BY GTX-327 (ASPEN PFD, OPTIONAL)

   FAULT ANNUNCIATION PROVIDED BY ASPEN PFD.

   TRAFFIC DISPLAY ON PED AND ASPEN EFD.

**Aspen Display and Control, GTX 327 Transponder**

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. LIGHT AIRCRAFT
Squat Mode................ none
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. Internal-GPS, 19200
Serial In  2.............. GTX-Remote, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. UNUSED, 115200
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. Disp-Ctrl, 38400 (RS-232)
Serial Out 6.............. Traffic-Alert, 38400 (RS-232)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1............... UNUSED, low
```

**Figure 2003. (Sheet 1 of 1) Aspen Display and Control, GTX 327 Transponder Interconnect Diagram**

ID-613121

**Bendix King KSN 765/770 Display and GPS, GTX-327 Transponder**
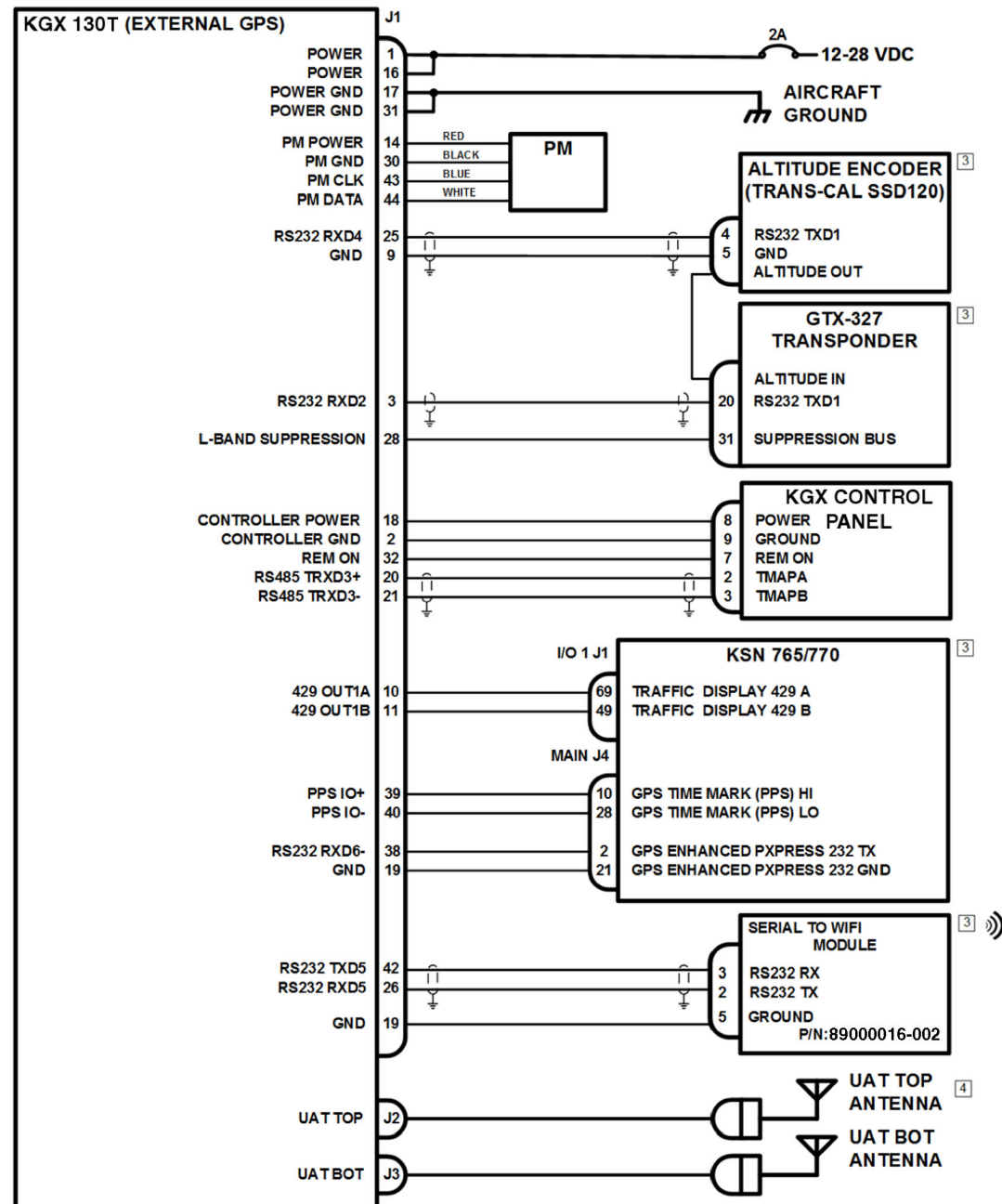


**Figure 2004. (Sheet 1 of 1) BendixKing KSN 765/770 Display and GPS, GTX-327 Transponder Interconnect Diagram**

## NOTES:

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS. REFER TO TABLE 2004 IN THIS SECTION FOR THE APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. SYSTEM DESCRIPTION:

   SQUAWK CODE, IDENT, MODE CONTROL ARE PROVIDED BY GTX-327.

   FAULT ANNUNCIATION PROVIDED BY KGX CONTROL PANEL.

   TRAFFIC DISPLAY ON BENDIX KING KSN 765/770 AND PERSONAL ELECTRONIC DEVICE.

**Bendix King KSN 765/770 Display and GPS, GTX-327 Transponder**

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. LIGHT AIRCRAFT
Squat Mode................ none
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. UNUSED, 9600
Serial In  2.............. GTX-Remote, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. UNUSED, 115200
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. GPS-KSN, 115200 (RS-232)
Serial Out 6.............. UNUSED, 115200 (RS-232)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1.............. Traffic, high
```

ID-613122
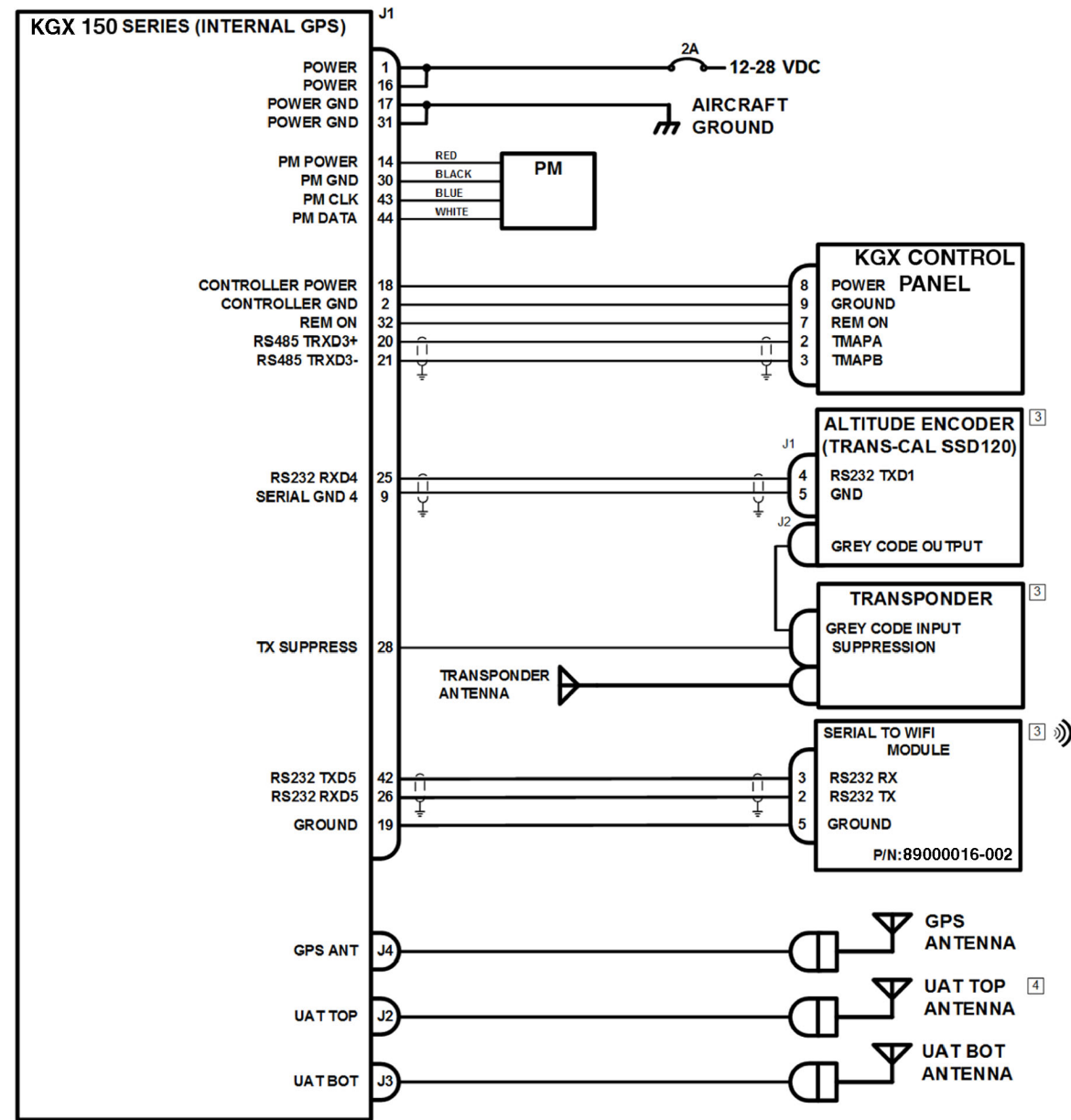
## Mode A/C Transponder, KGX Control Panel



**Figure 2005. (Sheet 1 of 1) Mode A/C Transponder, KGX Control Panel Interconnect Diagram**

**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. SYSTEM DESCRIPTION:

   SQUAWK CODE AND IDENT ARE PROVIDED BY TRANSPONDER.
   MODE CONTROL IS PROVIDED BY KGX CONTROL PANEL
   FAULT ANNUNCIATION PROVIDED BY KGX CONTROL PANEL
   TRAFFIC DISPLAY ON PERSONAL ELECTRONIC DEVICE.

   Mode A/C Transponder, KGX Control Panel

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. LIGHT AIRCRAFT
Squat Mode................ none
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. enable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. Internal-GPS, 19200
Serial In  2.............. UNUSED, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. UNUSED, 115200
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. UNUSED, 9600 (RS-422)
Serial Out 6.............. UNUSED, 9600 (RS-422)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1............... UNUSED, low
```

⚠ When a separate transponder is present, the KGX Control Panel will not accept inputs and will instead mirror the control inputs coming from the transponder or the display. If control input is lost from another device for 60 seconds, then the KGX Control Panel will take over the role as the primary controller.

ID-613123

## Garmin GNS 480, SL-70 Transponder, TCAS

KGX 150 (INTERNAL GPS) J1

| | | |
|---|---|---|
| POWER | 1 | |
| POWER | 16 | 2A — 12-28 VDC |
| POWER GND | 17 | AIRCRAFT |
| POWER GND | 31 | GROUND |
| PM POWER | 14 | RED |
| PM GND | 30 | BLACK — PM |
| PM CLK | 43 | BLUE |
| PM DATA | 44 | WHITE |
| 429 OUT 1A | 10 | GNS 480 [3] — 48 429 IN 1A |
| 429 OUT 1B | 11 | 49 429 IN 1B |
| REM ON* | 32 | *REM ON MUST BE GROUNDED |
| GROUND | 2 | TO POWER ON THE KGX |
| UAT STATUS | 41 | ADS-B ANNUNCIATOR [3] |

ALTITUDE ENCODER (TRANS-CAL SSD120) [3]

| | | J1 | |
|---|---|---|---|
| RS232 RXD4 | 25 | 4 | RS232 TXD1 |
| SERIAL GND 4 | 9 | 5 | GND |

J2

| | A1 | 2 |
| | A2 | 3 |
| | A4 | 4 |
| | B1 | 9 |
| | B2 | 10 |
| | B4 | 11 |
| | C1 | 12 |
| | C2 | 13 |
| | C4 | 1 |
| | D4 | 6 |
| | OUTPUT ENABLE | |

SL-70 TRANSPONDER [3]

| | COM | 30 |
| | D4 | 35 |
| | C4 | 15 |
| | C2 | 34 |
| | C1 | 16 |
| | B4 | 32 |
| | B2 | 14 |
| | B1 | 33 |
| | A4 | 12 |
| | A2 | 31 |
| | A1 | 13 |

| | | |
|---|---|---|
| RS232 RXD2 | 3 | 5 RS232 TXD1 |
| L-BAND SUPPRESSION | 28 | 19 SUPPRESSION BUS |

TCAS [3]

| | | |
|---|---|---|
| 429 IN 1B | 34 | TX B (ARINC 735B) |
| 429 IN 1A | 35 | TX A (ARINC 735B) |

| UAT BOT | J3 | UAT BOT ANTENNA |
| GPS ANT | J4 | GPS ANTENNA |

**Figure 2006. (Sheet 1 of 1) Garmin GNS 480, SL-70 Transponder, TCAS Interconnect Diagram**

### NOTES:

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS. SEE TABLE 2004, COMPATIBLE SOFTWARE VERSIONS, FOR APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. SYSTEM DESCRIPTION:

   SQUAWK CODE, IDENT, AND MODE CONTROL ARE PROVIDED BY SL-70.

   FAULT ANNUNCIATION PROVIDED BY DEDICATED ANNUNCIATOR.

   TRAFFIC DISPLAY ON GNS 480.

### Garmin CNS 480, SL Transponder, TCAS

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. LIGHT AIRCRAFT
Squat Mode................ low
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... bottom, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. Internal-GPS, 19200
Serial In  2.............. GSL-71, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. MAINT, 115200
Serial Out 5.............. MAINT, 115200
Serial In  6.............. UNUSED, 9600 (RS-422)
Serial Out 6.............. UNUSED, 9600 (RS-422)
ARINC In 1................ Traffic, low
ARINC In 2................ UNUSED, low
ARINC Out 1............... Traffic, low
```

ID-613127

**Garmin MX-20 Display and Control, No Transponder**

KGX 150 SERIES (INTERNAL GPS)   J1

| | |
|---|---|
| POWER | 1 |
| POWER | 16 |
| POWER GND | 17 |
| POWER GND | 31 |

2A
12-28 VDC

AIRCRAFT
GROUND

| | | |
|---|---|---|
| PM POWER | 14 | RED |
| PM GND | 30 | BLACK |
| PM CLK | 43 | BLUE |
| PM DATA | 44 | WHITE |

PM

ALTITUDE ENCODER
(TRANS-CAL SSD120) [3]

| | | | | |
|---|---|---|---|---|
| RS232 RXD4 | 25 | | 4 | RS232 TXD1 |
| SERIAL GND 4 | 9 | | 5 | GND |

MX-20 DISPLAY [3]

| | | | | |
|---|---|---|---|---|
| RS422 TXD6+ | 7 | | 11 | RS422 RXD4+ |
| RS422 TXD6- | 8 | | 26 | RS422 RXD6- |
| RS422 RXD6+ | 37 | | 8 | RS422 TXD4+ |
| RS422 RXD6- | 38 | | 10 | RS422 TXD4- |

SERIAL TO WIFI
MODULE [3]

| | | | | |
|---|---|---|---|---|
| RS232 TXD5 | 42 | | 3 | RS232 RX |
| RS232 RXD5 | 26 | | 2 | RS232 TX |
| GND | 19 | | 5 | GROUND |

P/N: 89000016-002

ANONYMOUS MODE   12

ANONYMOUS MODE
SWITCH

| | | |
|---|---|---|
| UAT TOP | J2 | UAT TOP ANTENNA [4] |
| UAT BOT | J3 | UAT BOT ANTENNA |
| GPS ANT | J4 | GPS ANTENNA |

**Figure 2007. (Sheet 1 of 1) Garmin MX-20 Display and Control, No Transponder Interconnect Diagram**

**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS. REFER TO TABLE 2004 IN THIS SECTION FOR THE APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. SYSTEMS DESCRIPTION:

SQUAWK CODE, IDENT, AND MODE CONTROL ARE PROVIDED BY MX-20.

FAULT ANNUNCIATION PROVIDED BY MX-20.

TRAFFIC DISPLAY ON MX-20.

**Garmin MX-20 Display and Control**

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. LIGHT AIRCRAFT
Squat Mode................ none
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. Internal-GPS, 19200
Serial In  2.............. UNUSED, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. UNUSED, 115200
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. Disp-Ctrl, 38400 (RS-422)
Serial Out 6.............. MX-20, 38400 (RS-422)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1............... UNUSED, low
```

ID-613129

**Garmin GMX-200 Display, GTX-330 Transponder**

**KGX 150 SERIES (INTERNAL GPS)** J1

| | | |
|---|---|---|
| POWER | 1 | |
| POWER | 16 | 2A → **12-28 VDC** |
| POWER GND | 17 | |
| POWER GND | 31 | **AIRCRAFT GROUND** |

| | | RED |
|---|---|---|
| PM POWER | 14 | RED |
| PM GND | 30 | BLACK |
| PM CLK | 43 | BLUE |
| PM DATA | 44 | WHITE |

**PM**

**GMX-200 DISPLAY** [3]

| | | | | |
|---|---|---|---|---|
| RS422 TXD6+ | 7 | 11 | RS422 RXD4+ |
| RS422 TXD6- | 8 | 26 | RS422 RXD6- |
| RS422 RXD6+ | 37 | 8 | RS422 TXD4+ |
| RS422 RXD6- | 38 | 10 | RS422 TXD4- |

**ALTITUDE ENCODER (TRANS-CAL SSD120)** [3]

| | | | | |
|---|---|---|---|---|
| RS232 RXD4 | 25 | 4 | RS232 TXD1 |
| SERIAL GND 4 | 9 | 5 | GND |
| | | 2 | RS232 TXD1 |

**GTX-330 TRANSPONDER** [3]

| | | | | |
|---|---|---|---|---|
| RS232 RXD2 | 3 | 22 | RS232 RXD1 |
| | | 25 | RS232 TXD2 |
| L-BAND SUPPRESSION | 28 | 31 | SUPPRESSION BUS |

**SERIAL TO WIFI MODULE** [3]

| | | | | |
|---|---|---|---|---|
| RS232 TXD5 | 42 | 3 | RS232 RX |
| RS232 RXD5 | 26 | 2 | RS232 TX |
| GND | 19 | 5 | GROUND |
| | | | P/N: 89000016-002 |

| | | |
|---|---|---|
| UAT TOP | J2 | **UAT TOP ANTENNA** [4] |
| UAT BOT | J3 | **UAT BOT ANTENNA** |
| GPS ANT | J4 | **GPS ANTENNA** |

**Figure 2008. (Sheet 1 of 1) Garmin GMX-200 Display, GTX-330 Transponder Interconnect Diagram**

**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.

2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.

3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECT. REFER TO TABLE 2004 IN THIS SECTION FOR THE APPLICABLE MINIMUM SOFTWARE VERSIONS.

4. FOR SINGLE ANTENNA INSTALLATIONS (CLASS A1S) INSTALL BOTTOM ANTENNA ONLY.

5. SYSTEM DESCRIPTION:

    SQUAWK CODE, IDENT, AND MODE CONTROL ARE PROVIDED BY GTX-330.

    FAULT ANNUNCIATION PROVIDED BY GMX-200.

    TRAFFIC DISPLAY ON GMX-200 AND PERSONAL ELECTRONIC DEVICE.

**Garmin GMX-200 Display, GTX-330 Transponder**

```
ICAO Address.............. FF00
VFR Call Sign............. FXVRGA
GPS Config................ Level C
NACv Mode................. Auto (from GPS)
Receiver Capability....... no1090, 978
Emit Category............. LIGHT AIRCRAFT
Squat Mode................ none
Groundspeed Threshold..... 0 knots
Vehicle Size.............. Length=0 meters, Width=0 meters
UAT Ant................... dual, No DC Gnd Chk
GPS Ant Offset............ Long=No Data, Lateral=No Data
Mode A Rx................. disable
Disable Squawk Tx......... off
Max Targets............... max
Chelton CSA Enable........ disable
Traffic Vel Validation.... enable
Display Data Output....... traffic&fisb
Serial In  1.............. Internal-GPS, 19200
Serial In  2.............. GTX-Remote, 9600
Serial Out 2.............. UNUSED, 9600
Serial In  3.............. TMAP, 38400
Serial Out 3.............. TMAP, 38400
Serial In  4.............. Alt-Encoder, 9600
Serial In  5.............. UNUSED, 9600
Serial Out 5.............. Traffic-Alert, 115200
Serial In  6.............. UNUSED, 38400 (RS-422)
Serial Out 6.............. Traffic-Alert, 38400 (RS-422)
ARINC In 1................ UNUSED, low
ARINC In 2................ UNUSED, low
ARINC Out 1............... UNUSED, low
```

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## 3. Equipment Specific Installations

### A. General

(1)  Refer to Table 2002 for a list of the equipment specific wiring diagrams

**Table 2002.  Equipment Specific Wiring Diagrams**

| Equipment | Figure Number |
|---|---|
| FreeFlight Systems 1201 GPS | Figure 2009 |
| FreeFlight Systems 1203C GPS | Figure 2010 |

**FreeFlight Systems 1201 GPS**
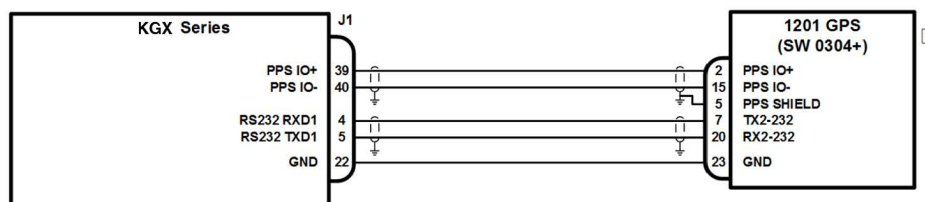


NOTES:

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.
2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.
3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS.  MINIMUM SOFTWARE (SW) VERSIONS MAY BE APPLICABLE.

**Figure 2009. (Sheet 1 of 1) FreeFlight Systems 1201 Wiring Diagram**

**FreeFlight Systems 1203C GPS**
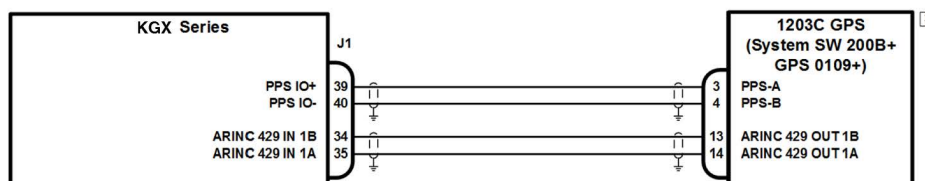


NOTES:

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.
2. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.
3. REFER TO INDIVIDUAL EQUIPMENT INSTALLATION MANUAL FOR EXTERNAL EQUIPMENT INTERCONNECTS.  MINIMUM SOFTWARE (SW) VERSIONS MAY BE APPLICABLE.

**Figure 2010. (Sheet 1 of 1) FreeFlight Systems 1203C Wiring Diagram**

## 4. Equipment Compatibility and Functions

### A. General

(1)  Refer to Table 2003 for a summary of the ADS-B transmit control function capabilities of various potential KGX series controllers. In accordance with AC20-165A the Squawk and IDENT should be controlled for the transponder and ADS-B out transmitter through a single point of entry.  There should also be an ADS-B fault annunciation for both ADS-B GPS loss/fault and ADS-B failure.

**Table 2003.  ADS-B Transmit Control Functions for Various KGX Controllers**

| Device Type | Device Model | Squawk Code/IDENT | Call Sign | TX Standby | Altitude Inhibit | ADS-B Fault Annuncia-tion |
|---|---|---|---|---|---|---|
| Transponder | Apollo SL-70 /RA | X | X | X | X | - |
| | Garmin GTX 330/33 | X | - | X | X | - |
| | Garmin GTX 327/32 | X | - | X | X | - |
| | Mode A/C Receive | X | - | - | - | - |
| | ARINC Transponder Controller | X | X | X | - | X |
| DIsplay Controller | Aspen EFD 500/1000 | X | - | - | - | X |
| | Garmin MX-20 | X | X | X | X | X |
| | Garmin GMX-200 | X | X | X | X | X |
| | Chelton Flight Logic | - | - | - | - | X |
| ADS-B Controller | BendixKing KGX Control Panel | X | X | X | X | X |
| | Garmin GSL 71 | X | X | X | X | - |

(2)   Refer to Table 2004 for the minimum compatible software versions as tested with the KGX series.

**Table 2004.  Compatible Software Versions**

| Device | Permitted Software Version |
|---|---|
| BendixKing KGX control panel | Software Version 1.13 or later FAA-approved version |
| Aspen EFD1000 PFD Aspen EFD1000 MFD Aspen EFD500 MFD | MAP 2.7.2 or later FAA-approved version IOP 2.0.5 or later FAA-approved version |
| MX20 MFD | Software Version 5.7 |
| GMX 200 MFD | Software Version 2.12 or later FAA approved version |
| Garmin GSL 71 UAT control panel | No Software Version is Identified |

**Table 2004.  Compatible Software Versions (Cont)**

| Device | Permitted Software Version |
|---|---|
| Chelton FlightLogic EFIS | Software Version 6.0B |
| WiFi module | All software versions |
| FreeFlight Model 1201 GPS as a position source | Software Version 0306 or later FAA-approved version |
| FreeFlight Model 1203C GPS | Software Version 200B or later FAA-approved version |
| Garmin 400W/500W series as a position source and/or ADS-B IN traffic source. | Main Software Version 5.03 or later<br>GPS Software Version 5.00 or later |

## 5.   Maintenance Interface Wiring Diagrams

### A.   General

(1)   This paragraph describes the various KGX series configuration and setup options available through the MPI.

(2)   Refer to Table 2005 for a list of the maintenance interface wiring diagrams. The diagrams provide a pictorial representation of available options for accessing the maintenance port of the KGX series.

**Table 2005.  Maintenance Interface Wiring Diagrams**

| Equipment | Figure Number |
|---|---|
| Off-the-shelf RS-232 to USB converter | Figure 2011 |
| Serial-to-WiFi module | Figure 2012 |
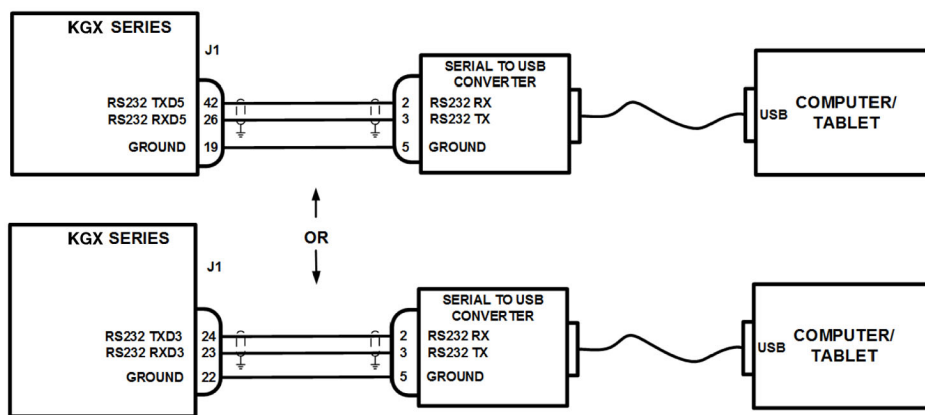


**NOTES:**

1.  ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED AND MUST BE MIL-W-16878E/4 OR EQUIVALENT.
2.  CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH AS SHORT OF A CONDUCTOR AS POSSIBLE. GROUND ONLY ONE END EXCEPT WHEN THE SHIELD IS ACTING AS THE SERIAL COMMON GROUND.
3.  REFER TO INDIVIDUAL INSTALLATION MANUALS FOR EXTERNAL EQUIPMENT INTERCONNECTS.

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**Figure 2011. (Sheet 1 of 1) Off-the-Shelf RS-232 to USB Converter Wiring Diagram**
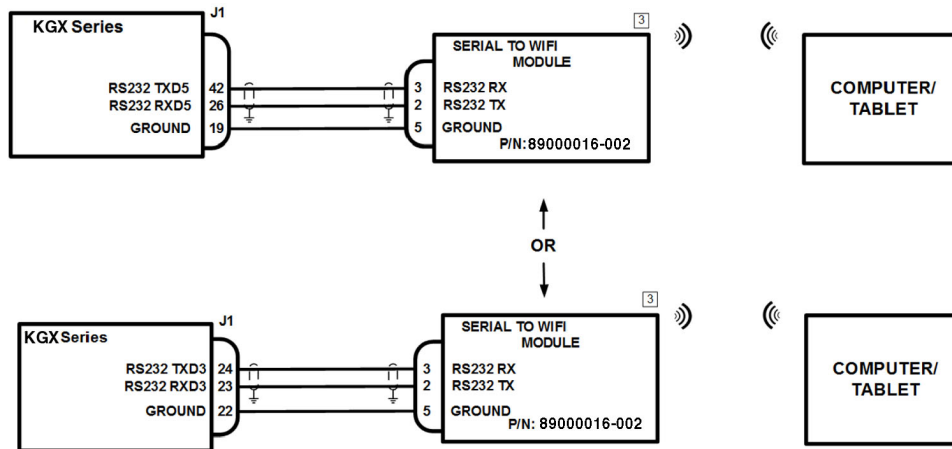
**Figure 2012. (Sheet 1 of 1) Serial-to-WiFi Module Wiring Diagram**

## 6. Warning Disclaimer

### A. General

**WARNING:** THE KGX SERIES PROVIDES FIS-B INFORMATION THAT CAN BE USED AS AN AID FOR SITUATIONAL AWARENESS ONLY. FIS-B INFORMATION PROVIDED MUST BE USED FOR ADVISORY USE ONLY AND SHOULD NOT BE USED FOR FLIGHT SAFETY CRITICAL INFORMATION AND OPERATION. THE USER IS ADVISED TO EXERCISE CAUTION AND LET COMMON SENSE PREVAIL WHEN CONFRONTED WITH SEVERE WEATHER CONDITIONS.

**WARNING:** THE KGX SERIES PROVIDES TRAFFIC INFORMATION THAT CAN BE USED AS AN AID FOR SITUATIONAL AWARENESS ONLY. PILOTS MUST RELY ON ATC GUIDANCE OR VISUAL RULES FOR VISUAL ACQUIRING TRAFFIC AND MANEUVERING THEIR AIRCRAFT IN TRAFFIC.

**WARNING:** THE KGX SERIES PROVIDES WEATHER INFORMATION THAT CAN BE USED AS AN AID FOR SITUATIONAL AWARENESS ONLY. WEATHER INFORMATION PROVIDED MUST BE USED FOR ADVISORY USE ONLY AND SHOULD NOT BE USED FOR FLIGHT SAFETY CRITICAL INFORMATION AND OPERATION. THE USER IS ADVISED TO EXERCISE CAUTION AND LET COMMON SENSE PREVAIL WHEN CONFRONTED WITH SEVERE WEATHER CONDITIONS.

(1) The warnings apply to the KGX series transceivers and receivers.

## 7. Wiring Considerations

### A. General

(1) The connection from the KGX 150T/130T transceiver to the KGX control panel uses a minimum of six signal lines:

- TMAP pair

- Power and ground pair

- Remote On discrete line plus associated ground line.

(2)    In a certified installation, MIL-W-16878E/4 or equivalent wire must be used. Wire gauge must be AWG 24 for all wires. Shielded, twisted wiring is recommended for the TMAP pair (and all serial data communication pairs) to improve electromagnetic emissions and susceptibility; one twist for each 1 to 2 inches (25.4 to 50.8 mm) is adequate. Other pairs in the bundle can also be twisted but are not required.

(3)    The distance between the KGX and the KGX control panel is limited by the impedance of the wire between them. The KGX control panel is powered by the KGX, not from aircraft power, and therefore the acceptable voltage drop in the power line limits the wire length. The KGX control panel needs an impedance of less than 1.0 ohm in the power line for satisfactory operation. The following table gives guidelines for typical aircraft hook-up wire.

NOTE:    Different brands can vary. Check your supplier for details.

(4)    Refer to Table 2006 for the wiring considerations.

**Table 2006.  Wiring Considerations**

| Gauge | Milliohm/Foot | Length for 0.5 Ohm |
|-------|---------------|--------------------|
| AWG 24 | 30.2 | 33.2 feet (10.12 m) |

(5)    An alternative to a harness built from individual wires, particularly for a long cable run, is to use a multi-core cable. Aviation grade cable with six or more cores is often more expensive than the individual wires.

NOTE:    Not all data cable is suitable for this application. Cables with solid cores must not be used, and cables must be selected based on the wear characteristics of their insulation material, including temperature rating, resistance to solvents and oils, and flammability. Most inexpensive commercial data cables have poor flammability properties.

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# CONFIGURATION, CALIBRATION, AND CHECKOUT

## 1. General

### A. Overview

(1) This section contains installation configuration, checkout, and basic operating procedures. More detailed operating procedures are contained in Pub. No. D201405000060, BendixKing KGX 150/130 ADS-B Certified Transceivers and Receivers Pilot's Guide.

(2) The list that follows identifies Honeywell publications that are related to this section:

- Pub. No. D201405000060, BendixKing KGX 150/130 ADS-B Certified Transceivers and Receivers Pilot's Guide.

### B. Continued Airworthiness Requirements

(1) The KGX requires no periodic maintenance or calibration. Maintenance is performed on an on-condition basis only. The KGX does a POST and is continually tested using a PBIT when the system is in operation. This method of testing will notify the operator of a failure. System software updates are accomplished using the MPI.

(2) Continued airworthiness can also be accomplished by determining the KGX installed system performance using the FreeFlight Systems FT-9000 Ramp Tester.

### C. KGX Control Panel Operation

(1) General

(a) The KGX can interface to a KGX Control Panel used in-flight by the pilot to control output of ADS-B messages. The KGX Control Panel receives its power from the KGX and communicates to it through an RS-485 serial port. The KGX Control Panel consists of the following components (refer to Figure 3001):

- Monochrome LCD

- VFR button

- FN button (function)

- CODE knob

- ENT button (enter)

- Mode selection knob

- IDT button (ident).

**Figure 3001. (Sheet 1 of 1) KGX Control Panel**

(2)    For instructions to use the KGX control panel, refer to Pub. No. D201405000060, BendixKing KGX 150/130 ADS-B Certified Transceivers and Receivers Pilot's Guide.

(3)    Display

    (a)    The display shows the operating mode of the KGX, the reported pressure altitude, and the current squawk code and call sign/flight ID. The wave symbol is displayed when the KGX transmits ADS-B messages. Refer to Figure 3002.

    (b)    The pressure altitude is displayed as a flight level, which is the pressure altitude in hundreds of feet. When non-standard atmospheric conditions apply this might not match the altimeter indicated altitude but will be correctly reported in the ADS-B message.

    (c)    Refer to Figure 3003 for the KGX 150/130T powered on in the airborne transmission mode with a pressure altitude of flight level 500 feet being displayed.

        • Squawk code

        • Call sign/flight ID

        • Reported pressure altitude in hundreds of feet.

    (d)    If an external controller is configured and functional with the KGX control panel installed, the KGX control panel displays status, but locks out user control inputs. Mode control is always provided by the external controller, so the position of the mode selection knob only serves to turn on power to the ADS-B system. When in the external control mode, the KGX control panel displays the squawk code and/or call sign/flight ID in reverse video, as shown in Figure 3004.

The wave symbol under the aircraft image traveling upward indicates that the KGX 150T/130T equipment is receiving ADS-B messages.

The wave symbol under the aircraft image traveling downward indicates that the KGX 150T/130T equipment is transmitting ADS-B messages.

The Reply Indicator is active when the KGX 150T/130T ADS-B equipment transmits and receives ADS-B messages. The KGX 150T/130T ADS-B Transceiver equipment receives ADS-B transmissions regardless of the transmission mode

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**Figure 3002. (Sheet 1 of 1) KGX Control Panel Wave Symbols**



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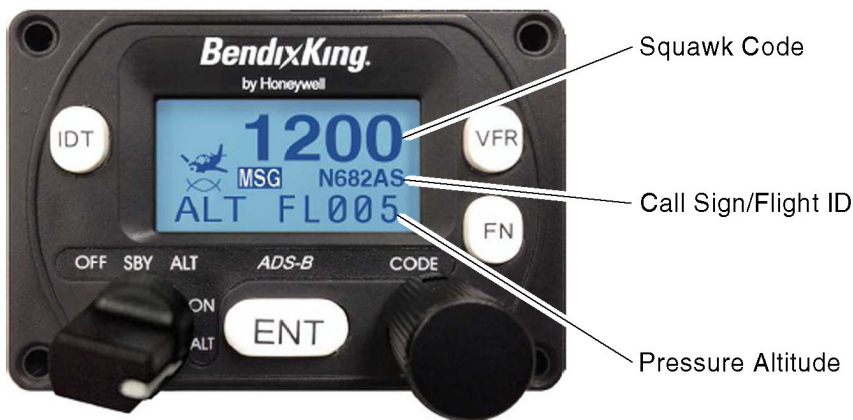
**Figure 3003. (Sheet 1 of 1) Display in ALT mode**



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**Figure 3004. (Sheet 1 of 1) Reverse Video Examples when KGX Control Panel is in External Control Mode**

(4)  System Messages

(a)  If the KGX detects a malfunction, the screen displays the MSG icon in the center of the LCD to indicate warning messages are present. Depending on the nature of the malfunction, the KGX may not be transmitting ADS-B messages. The Warning page is only available when the MSG icon is present.

(b)  To view the system messages on the Warning page, push the FN button four times. The WARNING is displayed top center along with a brief description of the fault.

(c)     When the Warning page is displayed, the KGX control panel continually requests the active system messages. The MSG icon remains shown as long as system messages are still present.

(d)     Push the FN button again to exit this mode and return to normal operation.

(e)     A log of system messages can be accessed using the MPI.

(5)     Fault Annunciation

(a)     If the transponder detects a catastrophic internal failure the screen will indicate FAULT with a brief statement of the problem. No ADS-B messages will be transmitted when a fault has been detected.

## 2.     Preliminary Checkout

### A.     Overview

(1)     Before the unit is installed and tested, verify that all cables are properly secured. With the KGX and KGX control panel removed, turn on aircraft power and verify the following.

(a)     Verify that aircraft DC bus voltage is present on Pins 1 and 16 of P1.

(b)     Verify that ground is present on Pins 17 and 31 of P1.

(c)     Verify that the two UAT antenna coax center conductors are not shorted to its shield or aircraft ground.

(2)     When the above conditions are verified, turn off the master power. Properly attach the external connectors to the KGX and KGX control panel. Mount the KGX and KGX control panel in their respective mounting locations. Turn on master power and then turn on the KGX control panel, if installed. During initialization the KGX unit performs a comprehensive diagnostics test.

(3)     A system component failure will be annunciated by a "Warning Indication" on the KGX control panel, if installed, or the display. Warnings concerning the GPS status may not be displayed until 2.5 minutes after power on in order to give the GPS time to acquire satellites. Consult the Pilot Guide for more information concerning warning messages. Detailed system status can be observed using the maintenance port Interface as described in CONFIGURATION, CALIBRATION, AND CHECKOUT.

(4)     The KGX aircraft installation must be verified to ensure compliant operation and configuration. Reference the applicable STC installation verification instructions.

(a)      The FFS FT-9000 ramp tester can be used for this purpose (refer to INSTALLATION, Table 1009 for more information). Use of the FFS STC data requires the use of the FT-9000 for installation verification.

(5)     Refer to Pub. No. D201405000060, BendixKing KGX 150/130 ADS-B Certified Transceivers and Receivers Pilot's Guide for more information about System Messages.

## 3.     Installation Setup and Configuration

### A.     General

(1)     System installation is configured using either:

• The MPI on serial Port 3 or Port 5 (typical) or,

• The KGX control panel, if installed, in a special configuration mode.

(2) Paragraph 3.B. thru Paragraph 3.C. describe the system installation configuration details necessary for configuring the KGX installation. Installers must review the information in these sections to make sure of the correct system configuration. It is important to carefully review Paragraph 3.C. to make sure of the correct system configuration of the serial and ARINC ports, regardless of using the MPI or KGX control panel for configuration.

(3) For reference, the configuration sections are organized as follows:

- Installation Setup and Configuration - General Configuration Details

- Configuration Item Summary - List of all Configuration Item

- Serial and ARINC Port Configuration Details - General Port Details

- Configuration and Setup Using MPI

- Configuration and Setup Using the KGX control panel.

**B. Configuration Item Summary**

(1) Refer to Table 3001 for the Serial and ARINC Port Configuration Settings.

(2) Refer to Table 3002 for the ADS-B transmit Configuration Settings.

(3) Refer to Table 3003 for the display output Configuration Settings.

(4) The setting column of the following tables can be used to document the system installation settings.

**Table 3001.  Serial and ARINC Port Configuration Settings**

| Configuration Item | Function/BAUD | Default | Setting |
|---|---|---|---|
| Serial Port 1 Configuration: | IN Function | Internal GPS | |
| | BAUD | 19200 | |
| Serial Port 2 Configuration: | IN Function | UNUSED | |
| | OUT Function | UNUSED | |
| | BAUD | 9600 | |
| Serial Port 3 Configuration: [1] | IN Function | TMAP | |
| | OUT Function | TMAP | |
| | BAUD | 38400 | |
| Serial Port 4 Configuration: | IN Function | UNUSED | |
| | BAUD | 9600 | |
| Serial Port 5 Configuration: | IN Function | MAINT | |
| | OUT Function | MAINT | |
| | BAUD | 115200 | |
| Serial Port 6 Configuration: | IN Function | UNUSED | |
| | OUT Function | UNUSED | |
| | BAUD | 9600 | |
| | Interface | RS-422 | |

**Table 3001.  Serial and ARINC Port Configuration Settings (Cont)**

| Configuration Item | Function/BAUD | Default | Setting |
|---|---|---|---|
| ARINC IN 1 Configuration: | Function | UNUSED | |
| | Speed | Low | |
| ARINC IN 2 Configuration: | Function | UNUSED | |
| | Speed | Low | |
| ARINC OUT 1 Configuration: | Function | UNUSED | |
| | Speed | Low | |

**NOTE:**

**1**    Serial Port 3 is not configurable on the KGX control panel.

**Table 3002.  ADS-B Transmit Configuration Settings**

| Configuration Item | | Default | Setting |
|---|---|---|---|
| ICAO Address (Mode S) | | 0 | |
| VFR Call Sign (Flight ID) | | | |
| GPS SDA Level | | UNKNOWN | |
| GPS NACv Mode | | UNKNOWN | |
| Receiver Configuration: | UAT Receiver Installed | 978 | |
| | ES1090  Receiver Installed | no1090 | |
| Emitter  (Aircraft) Category | | UNKNOWN | |
| Squat Mode | | none | |
| Groundspeed Threshold | | 0 knots | |
| Vehicle Size: | Length | 0 | |
| | Width | 0 | |
| UAT Antenna: | Diversity | Bottom | |
| | DC Ground Check | No DC Gnd Chk | |
| GPS Antenna Offset: | Longitudinal | No Data | |
| | Lateral | No Data | |
| Mode A Receive | | disable | |

**Table 3002. ADS-B Transmit Configuration Settings (Cont)**

| Configuration Item | Default | Setting |
|---|---|---|
| Disable Squawk Transmit [1] | off | |
| VFR Squawk Code [2] | 1200 | |

**NOTES:**

    **1**    Disable squawk transmit is not configurable on the KGX control panel.

    **2**    VFR squawk code is only set on the KGX control panel.

**Table 3003. Display Output Configuration Settings**

| Configuration Item | Default | Setting |
|---|---|---|
| Max Targets Output | max | |
| Chelton CSA Enable [1] | disable | |
| Traffic Velocity Validation [2] | enable | |
| Display Data Output [3] | traffic&fisb | |

**NOTES:**

    **1**    Chelton CSA Enable is not configurable on the KGX control panel.

    **2**    Traffic Velocity Validation is not configurable on the KGX control panel.

    **3**    Display data output is not configurable on the KGX control panel.

    (5)    Refer to Paragraph 4.F. for detailed information on determining the correct display output settings in Table 3003.

**C.   Serial and ARINC Port Configuration Details**

    (1)    General

        (a)    The KGX installation requires data interfaces to other equipment for a complete aircraft installation. The necessary data interfaces are as follows:

- Control input (transceiver only)
- TCAS input
- GPS input
- GPS predictive RAIM input
- Altitude input
- Display output
- GPS output.

(b)   The KGX serial and ARINC ports must be configured to enable these data interfaces and are described in Table 3004.

**Table 3004.  Data Interfaces for KGX Installation**

| Interface | Description |
|---|---|
| Control input | Control inputs such as flight plan ID (squawk code), call sign, and mode control (IDENT, Altitude Inhibit, transmit Standby) are needed by the KGX. The KGX control panel provides control or the KGX can be configured for other control formats. If a control format is configured and functional with the KGX control panel installed, the KGX control panel displays control status but will not accept control inputs. Serial Port 2 is typically used for control input. Control Input is NOT required for receive only systems. |
| GPS input | The KGX requires position, velocity, time, and integrity data from a GPS sensor. The internal GPS can be used (if equipped) or an external GPS shall be configured to supply this data. GPS Input is required for all KGX systems. |
| Altitude input | The KGX requires external pressure altitude data input from an altitude/air data sensor (ADS). Altitude rate and airspeed shall be used if available in the configured protocol. Pressure altitude data output can also be configured to share with a transponder. Serial Port 4 is typically used for altitude Input. Pressure altitude input is required for all KGX systems. |
| Heading input | The KGX can optionally receive aircraft true heading data. True heading is sent in UAT transmit messages on the ground and is also used to more accurately correlate TCAS and ADS-B Traffic. Heading input is not required but desirable with TCAS installations. |
| TCAS input | If the aircraft is equipped with TCAS traffic it shall be input to the KGX so the TCAS traffic can be integrated with ADS-B traffic and one traffic picture can be presented to the Display output. The KGX accepts TCAS traffic input through ARINC input per the ARINC 735 A/B Intruder Labels. |
| Display output | ADS-B traffic and FIS-B data output can be sent to one or more displays simultaneously. A display control can also be configured to provide the Control Input. Three different serial ports can be configured to simultaneously provide display output:<br><br>• Display on Serial Port 3<br><br>• Display on Serial Port 5<br><br>• Display on either Port 2 or Port 6.<br><br>ARINC OUT1 can also be configured to output ARINC 735 A/B Intruder Traffic. |

**Table 3004. Data Interfaces for KGX Installation (Cont)**

| Interface | Description |
|---|---|
| GPS Output | The KGX series models with internal GPS can output GPS position, velocity, time, and integrety data thru the RS-232 and/or ARINC 429. Internal GPS models automatically output GPS data in the FFS/Chelton protocol on Port 1. Also, the ARINC 429 output port can be configured to output ARINC 743 A/B compatible GPS messages. |
| GPS Predictive RAIM | The KGX series models with internal GPS can receive and respond to predictive RAIM (PRAIM) requests for a destination or alternate waypoint through the RS-232 or ARINC 429. A FMS can request the GPS to provide a RAIM prediction on serial Port 1 input or a PRAIM configured ARINC 429 input. The PRAIM responses are sent on serial Port 1 RS-232 or the 743 A/B configured ARINC 429 output respectively. |

(c)    ARINC and serial ports are set by the installer to specific data formats which supply the necessary data interfaces. All data interface types (except display output) from Table 3004 can be configured to one and only one ARINC or serial port.

(d)    If multiple ARINC/serial ports are set to the same data interface type then only one port is actually configured and all other settings of the same data interface type are ignored. The data interface order of precedence is as follows:

- ARINC 429 ports take precedence over UART serial ports
- Lowest port channel number takes precedence over higher channel number.

(e)    For example, if the KGX has an internal GPS and serial IN 1 is set to GPS-Internal and ARINC IN 1 is set to GPS-743, then the KGX will not receive GPS data from the internal GPS.

(f)    Set only one control input, only one altitude input, and only one GPS input. Inadvertently setting more than one of the same input type can result in the correct input data not being received.

(g)    Only one function can typically be set to either the input or output of each bidirectional serial Port (2, 3, 5, or 6). If the serial port input is set to a function then the output must be set to UNUSED and vice versa. If a serial port's input and output are both set only one setting is configured and unexpected operation can occur. The exception is if a display output is set on a port output then the port input can be set to display control otherwise the input must be set to UNUSED.

(h)    Control input is not required for receive only systems.

(i)    Using the Android tablet ADS-B MPI application significantly improves system configuration and troubleshooting through use of a GUI. The ADS-B MPI application includes additional and improved automated status feedback and automatic enforcement of the above configuration rules that is not available when configuring the system with the KGX control panel or the simple terminal program MPI interface. The ADS-B MPI application requires use of a serial-to-WiFi transceiver, KGW WiFi module, PN 89000016-002, properly connected to Port 3 or Port 5.

(2)    Serial Port Input Configuration

(a)    Serial port input data formats and baud rate settings are described in Table 3005 and Table 3006.

**Table 3005.  Serial Port Input Configuration Settings**

| Setting [1] | Inter-face | Description |
|---|---|---|
| UNUSED (not used) | - | No connection to serial port. |
| ADS (Air Data Computer) | Altitude Input | Altitude, airspeed, and vertical rate data input. Format for air data sensors using the protocol in SERIAL INTERFACE SPECIFICATIONS, Paragraph 3. |
| Alt-Encoder (altitude encoder) | Altitude Input | Altitude data. Format for air data sensors using the protocol in SERIAL INTERFACE SPECIFICATIONS, Paragraph 2. |
| Internal-GPS (GPS internal) | GPS Input | GPS position, velocity, time, and integrity data input and output. Selects use of the internal GPS (KGX 150 series only). Baud rate must be set to 19200. Internal GPS is only valid for serial Port 1. The internal GPS data is used by the KGX 150 series and GPS data is automatically output at 19200 baud on serial output Port 1using the FFS/Chelton protocol. The output is TSO-C145c Class Beta 1 certified and can be used as an ADS-B position source or navigation source. |
| GPS-FFS [4] (GPS-FreeFlight) | GPS Input | GPS position, velocity, time, and integrity data input. Format for the FFS 1201 or other sensors that support the FFS/Chelton protocol. Typically configured on Port 1. |
| GPS-ADS-B Plus [4] (GPS-GNS ADS-B) | GPS Input | GPS position, velocity, time, and integrity data input. Format for the Garmin Series 400W/500W ADS-B Plus GPS protocol. Typically configured on Port 1. |
| GPS-KSN [4] (GPS - aviation) | GPS Input | GPS position, velocity, time, and integrity data input. Format for the BendixKing KSN 765/770 GPS PXPRESS protocol. Typically configured on Port 4 or Port 6 (configured for RS-232). |
| GSL-71 (control panel) | Control Input [2] | Squawk code, IDENT, call sign, mode (standby/alt inhibit), and altitude data input. Format for the GSL-71 control panel or SL 70 transponder. [5] |
| GTX-Remote (GTX remote) | Control Input [2] and GPS Output | Squawk code, IDENT, call sign, and mode (standby/alt inhibit) input. Format for GTX 330/33/327/32 transponders. [5] |
| Disp-Cntrl (TIS/FIS) | Control Input [3] | Squawk code, IDENT, call sign, and mode (standby/alt inhibit). Enables display control from an MX-20, GMX-200, or other displays using the GDL/FDL protocol. The corresponding serial output port must be configured to TIS-FIS or MX-20 at the same baud rate to enable display control input. [2] [5] |

**NOTES:**

1. The MPI setting names are listed first with KGX control panel configuration menu setting names in parenthesis ().
2. Control Input is not required for receive only systems.
3. Setting an input port to Disp-Cntrl (TIS/FIS) must correspond to setting the same output port to a display output. For example, if serial Port 6 output is set to Traffic-Alert (TIS/FIS) then serial Port 6 input can be set to either Disp-Cntrl (TIS/FIS) to enable display control or UNUSED (not used) to disable display control. Only one display port should be set to (Disp-Ctrl).

**Table 3005.  Serial Port Input Configuration Settings (Cont)**

| | |
|---|---|
| **4** | Refer to SYSTEM INTERCONNECT DIAGRAMS, Table 2001 and Table 2004 for examples of wiring with one or two pin time mark output. |
| **5** | If any port is configured with these settings on a system with a KGX control panel installed, the KGX control panel does not accept inputs and instead mirrors the control inputs coming from the transponder or the display.  If control input is lost from another device for 60 seconds, then the KGX control panel takes over the role as the primary controller. |

**Table 3006.  Serial Port Input Baud Rate Settings**

| Setting | Description |
|---|---|
| 4800, 9600, 19200, 38400, 57600, 115200 | These baud rates are typical for RS-232 or RS-422 equipment but the correct rate must be selected to match the interfacing equipment's configured or default baud rate. |
| 230400, 460800 | These high baud rates are not recommended for RS-232 serial ports. |

(3)  Serial Port Output Configuration

    (a)  Serial port output data formats and baud rate settings are described in Table 3007 and Table 3008.

**Table 3007.  Serial Port Output Configuration Settings**

| Setting [1] | Interface | Description |
|---|---|---|
| UNUSED (Not Used) | - | No connection to serial port |
| Alt-Encoder (Encoded Altitude) | Altitude Output | Altitude data. Format for sending altitude to a transponder or display using the protocol in Paragraph 2. |
| Xpndr-Monitor (XPDR Monitor) | Control Input | Sends requests for squawk code and IDENT input data. (Xpndr-Monitor Protocol) This selection requires both serial input and output connections. [2] |
| Traffic-Alert (TIS/FIS) | Display Output | Ownship data, traffic reports, and FIS-B data. Format for the Aspen, GMX-200, Chelton displays, or other displays using the GDL/FDL protocol. The corresponding serial port input can be configured to Disp-Cntrl to enable display control input. [3] [5] [6] |
| Pass-Thru (ADS-B Pass Thru) | Display Output | Ownship data, ADS-B traffic data, and FIS-B data. Format for sending unprocessed, uncorrelated, and un-prioritized raw ADS-B messages. Traffic must be processed in another device to meet TSO-C195a ASSAP installation requirements. [3] |
| MX-20 (MX-20) | Display Output | Ownship data, traffic reports, and FIS-B data. Format for the MX-20. The corresponding serial input port can be configured to Disp Cntrl at the same baud rate to enable display control input. [3] [4] |

**NOTES:**

| | |
|---|---|
| **1** | Maintenance port setting names listed first with KGX control panel configuration menu setting names in parenthesis (). |

**Table 3007.  Serial Port Output Configuration Settings (Cont)**

**2**  Xpndr-Monitor selection requires a serial input and output port for operation.  If, i.e., Port 2 output is set to Xpndr-Monitor then serial Port 2 input is automatically used for Xpndr-Monitor input and serial Port 2 input should be set to 'UNUSED'.  Only used with FTM-190C at 9600 baud rate.  The internal Xpndr-Monitor function is set in accordance with Paragraph 4.E. Step (13).

**3**  Setting Disp-Cntrl for an input port must correspond to setting a display output on the same output port. i.e., if serial Port 6 output is set to MX-20 or Traffic-Alert then serial Port 6 input can be set to Disp-Cntrl to enable control.

**4**  For proper traffic and status presentation on legacy displays, review display settings in Paragraph 4.F. Steps (3) and (4) and set accordingly.

**5**  When using the KGX WiFi transceiver, make sure that the port is configured for Traffic Alert.

**6**  Configure at baud rate of 38400 when using Chelton Flight Logic display.  Make sure that the CSA bit is set in accordance with Paragraph 4.F. Step (3).

**Table 3008.  Serial Port Output Baud Rate Settings**

| Setting | Description |
|---|---|
| 4800, 9600, 19200, 38400, 57600, 115200 | These baud rates are typical for RS-232 or RS-422 equipment but the correct rate must be selected to match the interfacing equipment's configured or default baud rate. |
| 230400, 460800 | These high baud rates are not normally recommended for RS-232 serial ports. |

(4)  ARINC 429 Port Input Configuration

(a)  The ARINC 429 input data formats and speed configuration settings are described in Table 3009 and Table 3010.

**Table 3009.  ARINC 429 Port Input Configuration Settings**

| Setting [1] | Interface | Description |
|---|---|---|
| UNUSED (not used) | - | No connection to ARINC 429 input port. |
| ADC (Air Data Computer) | Altitude Input | Altitude, Airspeed, Vertical Rate data input. Format for air data sensors and computers that output the ADC Labels listed in Table 3014. |
| ADC&AHRS (ADC+AHRS) | Altitude & Heading Input | Altitude, Airspeed, Vertical Rate, & True Heading data input. Format for devices that output the Labels listed in Table 3014 and Table 3015. |
| AHRS (AHRS) | Heading Input | True Heading data input. Format for devices that output the True Heading Label 314 |
| Transpndr-Cntrl (Txpdr Control) | Heading Input | Squawk code, IDENT, and call sign. Format for transponders or controllers that output the ARINC Transponder Control Data Labels listed in Table 3013. |
| GPS-743 (GPS) | GPS Input | GPS position, velocity, time, and integrity data input. Format for the sensors that output the ARINC 743A labels (listed in Table 3011) and ALSO outputs a Time Mark that is UTC second synchronized. |

**Table 3009.  ARINC 429 Port Input Configuration Settings (Cont)**

| Setting [1] | Interface | Description |
|---|---|---|
| Traffic (Other 1) | TCAS Input | TCAS Intruder Traffic data input. Format for TCAS that output the Labels listed in the Traffic Input Table 3016. |
| GPS-PRAIM-743 (Other 2) | GPS Input | Accepts PRAIM input labels from FMS or other ARINC 743 A/B devices. |

**NOTE:**

    **1**    Maintenance port setting names listed first with KGX control panel configuration menu setting names in parenthesis.

**Table 3010.  ARINC Port Input Speed Configuration Settings**

| Setting | Description |
|---|---|
| Low | Low speed ARINC 429 - 12.5 kBaud |
| High | High speed ARINC 429 - 100 kBaud |

    (b)    The ARINC 429 Input channels accept the following input labels, as shown in Table 3011 thru Table 3016.

**Table 3011.  GPS-743 Input ARINC Labels**

| Label | Description |
|---|---|
| 273 | Sensor status |
| 110 | Latitude |
| 111 | Longitude |
| 120 | Latitude fine |
| 121 | Longitude fine |
| 125 | UTC |
| 103 | Track angle |
| 112 | Ground speed |
| 130 | HIL |
| 133 | VIL |
| 165 | Vertical speed |
| 166 | N/S velocity |
| 174 | E/W velocity |
| 136 | VFOM |
| 247 | HFOM |
| 260 | Date (BCD) |
| 370 | HAE |

**Table 3011.  GPS-743 Input ARINC Labels (Cont)**

| Label | Description |
|-------|-------------|
| 142 | Velocity vertical FOM |
| 145 | Velocity horizontal FOM |
| 140 | UTC, fine |
| 141 | UTC, fine fraction |
| 150 | UTC |

**NOTE:**

1    Data content must conform to the navigation data block of ARINC 743 A/B.

**Table 3012.  GPS-PRAIM-743 Input ARINC Labels**

| Label | Description |
|-------|-------------|
| 152 | PRAIM destination ETA |
| 144 | PRAIM destination latitude |
| 143 | PRAIM destination longitude |
| 146 | PRAIM satellite deselect #1 |
| 170 | PRAIM satellite deselect #2 |

**Table 3013.  Transpnder-Cntrl Input ARINC Labels**

| Label | Description |
|-------|-------------|
| 016 | TCAS/ATC control (squawk code and IDENT only) |
| 031 | ATCRBS control (squawk code and IDENT only) |
| 233 | Flight ID Characters 1 and 2 |
| 234 | Flight ID Characters 3 and 4 |
| 235 | Flight ID Characters 5 and 6 |
| 236 | Flight ID Characters 7 and 8 |

**NOTES:**

1    Label 016 or 031 must be present as a minimum.
2    Label 016 or 031 control only squawk code and IDENT.
3    Labels 233 thru 236, if present, control call sign.

**Table 3014.  ADC Format Input ARINC Labels**

| Label | Description |
|-------|-------------|
| 203 | Pressure altitude |
| 210 | Airspeed |
| 212 | Altitude rate |

**Table 3015.  AHRS Format Input ARINC Labels**

| Label | Description |
|---|---|
| 314 | True heading |

**Table 3016.  Traffic Format Input ARINC Labels**

| Label | Description |
|---|---|
| 274 | TCAS output - Receiver health in system status |
| 350 | Fault summary - TA only mode set in RI field |
| 314 | True heading |
| 357 | RTS and ETX words for intruder file |
| 130 | Intruder range |
| 131 | Intruder altitude |
| 132 | Intruder bearing |

(5)    ARINC 429 Port Output Configuration

(a)    The ARINC 429 output data formats and speed configuration settings are described in Table 3017 and Table 3018.

**Table 3017.  ARINC 429 Port Output Configuration Settings**

| Setting [1] | Interface | Description |
|---|---|---|
| UNUSED (not used) | - | No connection to ARINC 429 output port. |
| Traffic (traffic) | Display Output | Ownship data and traffic intruder data format for displays that receive the ARINC 735 A/B traffic labels listed in Table 3020. |
| GPS-743 (GPS) [2] | GPS Output | GPS position, velocity, time, and integrity data output in ARINC 743 A/B labels shown in Table 3020. |

**NOTES:**

**1**    Maintenance port setting names listed first with KGX control panel configuration menu setting names in parenthesis ().

**2**    PRAIM labels output only if the input is configured to accept PRAIM requests.

**Table 3018.  ARINC 429 Port Output Speed Configuration Settings**

| Setting | Description |
|---|---|
| Low | Low speed ARINC 429 - 12.5 kBaud |
| High | High speed ARINC 429 - 100 kBaud |

(b)    The ARINC 429 Output channel can be configured as shown in Table 3019.

**Table 3019. Traffic Format Output ARINC Labels**

| Label | Description |
|-------|-------------|
| 130 | Intruder range |
| 131 | Intruder altitude |
| 132 | Intruder bearing |
| 270 | Vertical resolution advisory |
| 274 | TCAS output - Receiver health in system status |
| 350 | Fault summary - TA only mode set in RI field |
| 357 | RTS and ETX words for intruder file |

**Table 3020. GPS-743 Output Labels Order**

| Setting | Description [3] |
|---------|-------------|
| 273 | Sensor status |
| 076 | Altitude (MSL) |
| 110 | Latitude |
| 111 | Longitude |
| 120 | Latitude fine |
| 121 | Longitude fine |
| 125 | UTC |
| 103 | Track angle |
| 112 | Ground speed |
| 130 | HIL |
| 133 | VIL |
| 165 | Vertical velocity |
| 166 | N/S velocity |
| 174 | E/W velocity |
| 136 | VFOM |
| 247 | HFOM |
| 261 | Date (BNR) |
| 260 | Date (BCD) |
| 370 | Height above elipsoid |
| 371 [2] | General average equipment ID code |
| 377 | Equipment ID |
| 101 | HDOP |
| 102 | VDOP |

**Table 3020. GPS-743 Output Labels Order (Cont)**

| Setting | Description [3] |
|---------|-----------------|
| 142 | Velocity vertical FOM |
| 145 | Velocity horizontal FOM |
| 140 | UTC, fine |
| 141 | UTC, fine fraction |
| 150 | UTC |
| 162 [1] | PRAIM response destination ETA |
| 343 [1] | PRAIM response destination HIL |

**NOTES:**

1   PRAIM output only sent if an ARINC input is configured to GPS-PRAIM-743.

2   Label 371, General Aviation Equipment Identification Code, are part of the ARINC 429 General Aviation Subset (published by GAMA) and are not part of the labels defined in ARINC 743.

3   Data content conforms to Attachment 4-2 of ARINC 743A-5.

## 4. Configuration and Setup Using MPI

### A. General

(1)   This section describes KGX configuration and setup through the MPI on Serial Port 3 or 5. The MPI connections detailed in Paragraph 10.J. can be connected to a PC or Tablet through one of following two devices:

- Off-the-shelf RS-232 to USB converter

- WiFi module (PN 89000016-002) from BendixKing.

(2)   Refer to Paragraph 4.B. for descriptions on connecting the above devices from the KGX to a PC or Tablet.

(3)   The WiFi module (BendixKing PN 89000016-002) can use the available MPI Tablet Application. The MPI Tablet Application provides a complete GUI for configuring, troubleshooting, and updating the system. The MPI Tablet Application, called "ADS-B MPI", includes user documentation and can be obtained from the Google Play store or through FreeFlight Systems. An example screenshot is shown in Figure 3005.
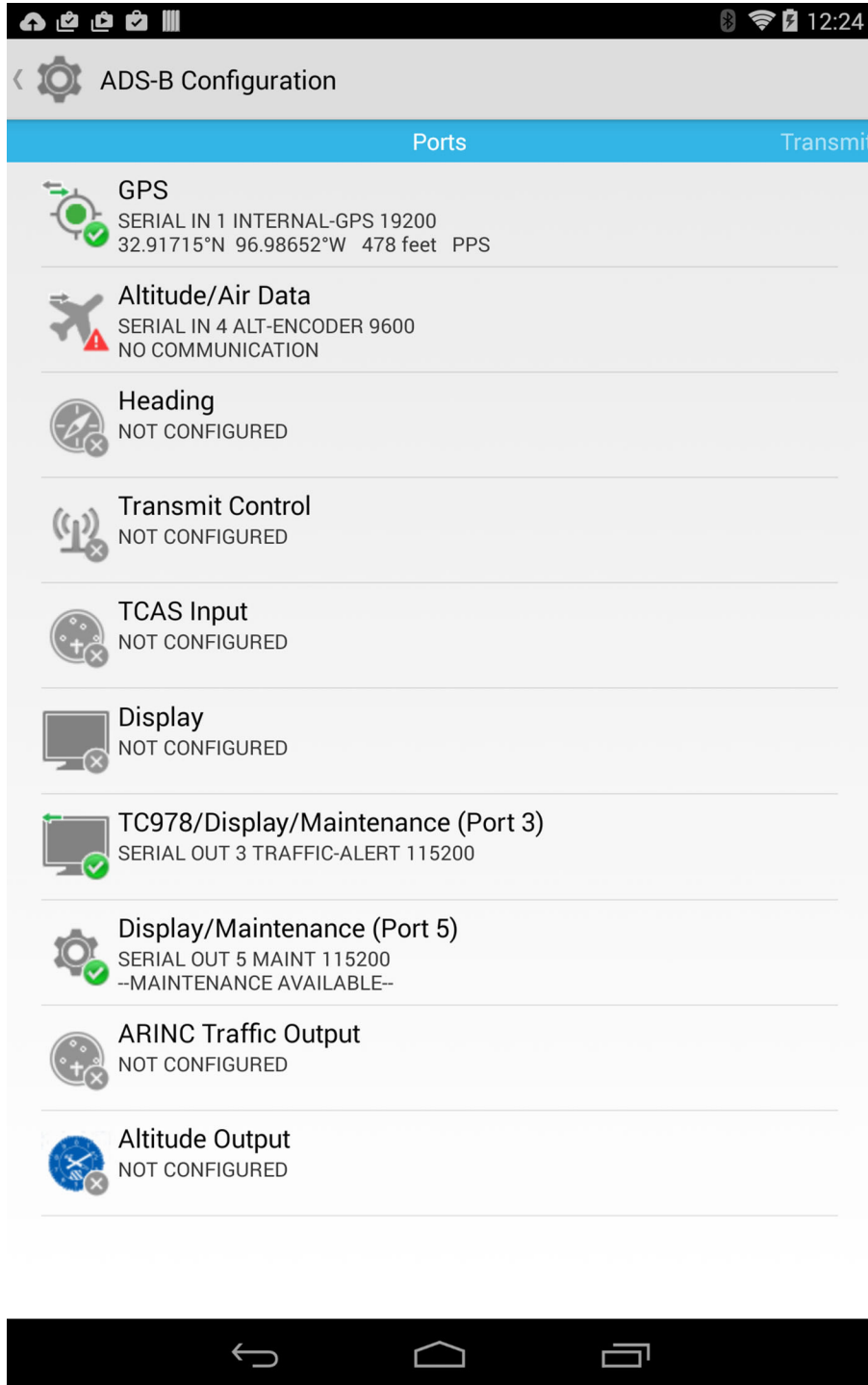
**Figure 3005. (Sheet 1 of 1) ADS-B MPI Screenshot**

(4) The following paragraphs describe interfacing directly to the MPI using a terminal interface program on a PC, like "Tera Term", to enter MPI commands. Any of the two interface devices mentioned above can be used to interface to the PC.

(5) Terminal Program Interface

(a) "Tera Term" (or another terminal interface program) must be installed on the PC and an MPI connection made through serial port or WiFi depending on the interface device used. The following paragraphs detail the serial port settings and WiFi settings.

1 Tera Term Terminal Setup (refer to Figure 3006)

a Local Echo – checked.

b The default MPI port settings for a serial connection are shown in Table 3021 and Figure 3007. These settings applicable to all MPI devices (USB-to-serial, MPI module, and aircraft WiFi module)

**Table 3021.  Default MPI Port Configuration Settings**

| MPI Port | Baud | Parity | Data | Stop | Flow Control |
|----------|------|--------|------|------|--------------|
| 3 | 38400 | Odd [1] | 8 Bit | 1 Bit | None |
| 5 | 115200 | None | 8 Bit | 1 Bit | None |

**NOTE:**

1 Odd parity is only required if Port 3 is configured to TMAP at 38400 baud.  If the port has changed from either of these default settings, Parity should be set to None.

2 MPI WiFi Connection Settings

a A WiFi connection to the WiFi module SSID must first be made on the PC. Refer to Table 3022 and Figure 3008.

**Table 3022.  Tera Terminal WiFi Connection Settings**

| Setting | MPI Module | KGX WiFi Module |
|---------|-----------|-----------------|
| Host | 192.168.10.1 | 192.168.5.1 |
| TCP Port | 44000 | 4000 |
| Service | Other | |
| Protocol | UNSPEC | |

3 Initial MPI Connection

a Once connected to the MPI with a serial or WiFi connection, push the <Enter> key three times to remove the maintenance lockout.  The following prompt must be displayed in the terminal window.

- KGX-150T> / KGX-130T> (KGX 150T/130T Transceivers) or

- KGX-150R> / KGX-130R> (KGX 150/130 Receivers).
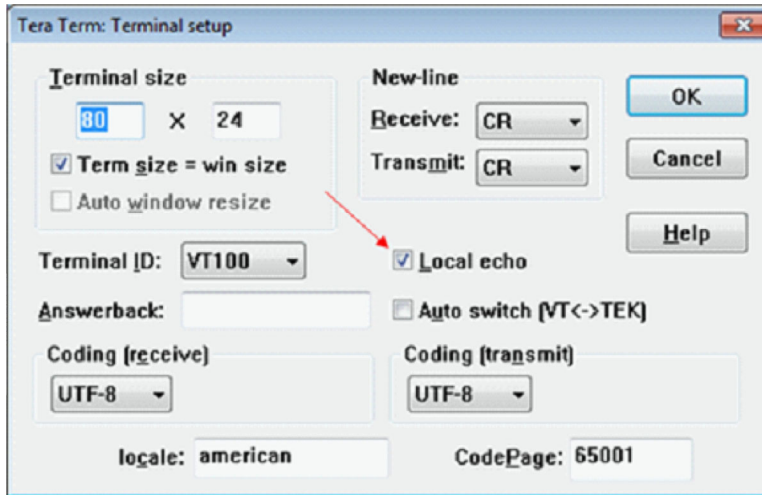
**Figure 3006. (Sheet 1 of 1) Tera Term Terminal Setup**
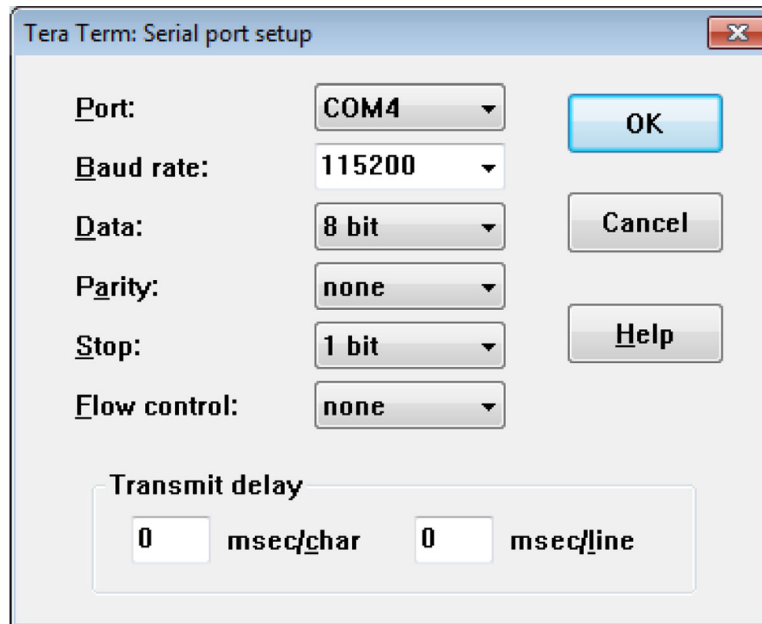
**Figure 3007. (Sheet 1 of 1) Tera Term Serial Port Setup**
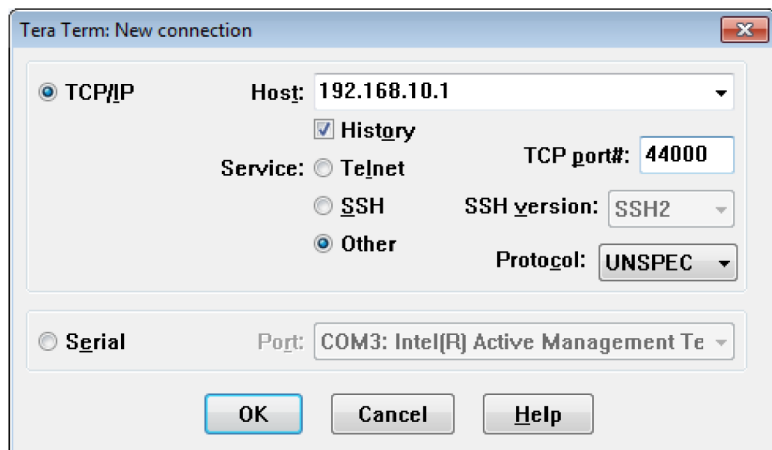
**Figure 3008. (Sheet 1 of 1) Tera Term WiFi Connection Settings Initial MPI Connection**

**B.    KGX Maintenance Interface Diagrams**

   (1)    Maintenance Interface Diagrams for configuring the KGX through the MPI are represented in Figure 3009 and Figure 3010.
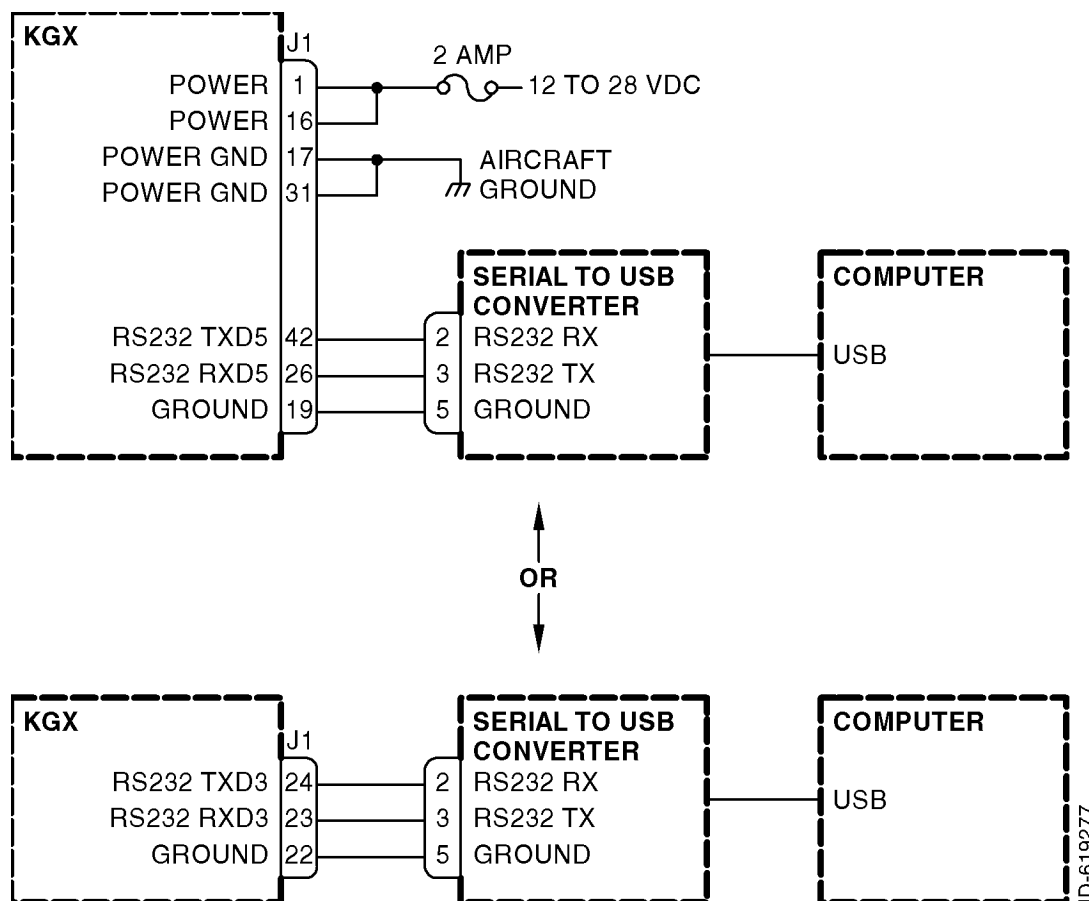


**Figure 3009. (Sheet 1 of 1) Off-the-shelf RS-232 to USB Converter**
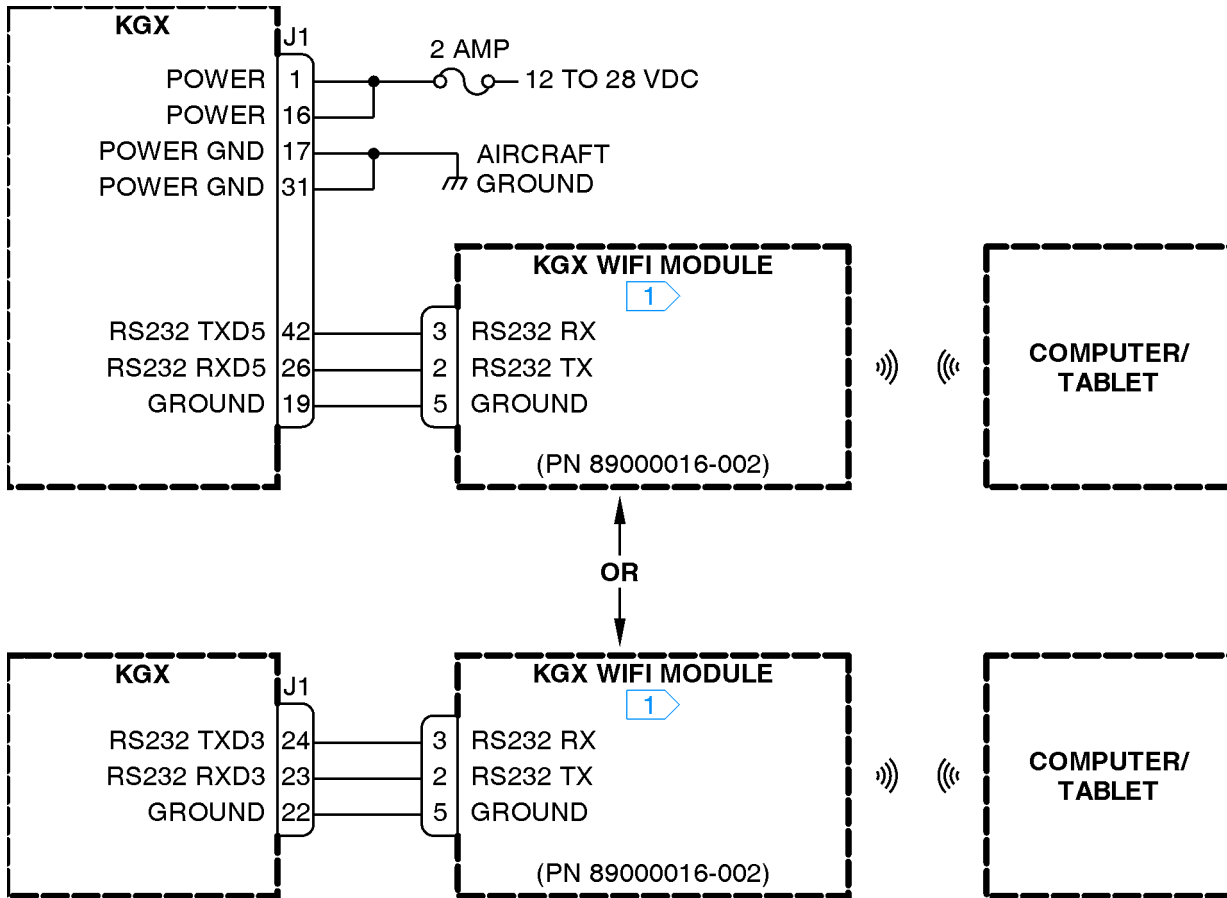
**NOTE:**
1 ▷ For desktop or tablet maintenance applications.

**Figure 3010. (Sheet 1 of 1) KGX WiFi Module**

C.   **Terminal Maintenance Commands**

(1)   Overview

(a)   The available commands are summarized in Table 3023.

**Table 3023.  Available Maintenance Commands**

| Command | Description |
|---------|-------------|
| ads | Display data from the altitude/air data input |
| bit | Display built-in test status |
| clear | Clear the screen |
| comm | Display communication port's status - continuous |
| control | Display control squawk and mode status |
| cnfg | Display configuration data |
| gps | Display data from the GPS input |

**Table 3023. Available Maintenance Commands (Cont)**

| Command | Description |
|---|---|
| help or ? | Display command help |
| info | Display info - SN, operation hours, versions, etc. |
| Reset | Reset and restart the unit |
| resetpw | Disable MPI access password (See Section 6, G) |
| rxstatus | Display receiver status info - continuous |
| set <item> <value> | Set a configuration item's value |
| setpw | Set MPI access password (See Section 6, G) |
| cnfg defaults | Reset configuration to defaults |
| stop | Stop continuous data outputs |

    (2)    "help or ?" Command

        (a)    This command displays a list of available commands. Refer to Figure 3011.



```
RANGR-XVR> help

 AVAILABLE COMMANDS.....
  ?                This help
  info             Display SN, operation hours, versions, etc.
  bit              View POST and PBIT status
  cnfg             Display configuration data
  cnfgdefaults     Reset configuration to defaults
  set              "set <item> to <opt>" or "set ?" for usage
  Reset            Reset the UAT
  comm             Display communication ports' status
  ads              Display air data
  gps              Display GPS data
  stop             Stop continuous update
  clear            Clear the terminal screen
  setpw            Set MPI access password
  resetpw          Disable MPI access password
  control          Display control squawk and mode status
  rxstatus         Display receiver status info
```
ID-619278

**Figure 3011. (Sheet 1 of 1) "help or ?" Command**

    (3)    "ads" Command

        (a)    This command displays the data from the altitude/air data input interface. Refer to Figure 3012.



```
RANGR-XVR> ads

 ADS Data
  Altitude:   302 ft, Vert Rate:   64 ft/min, BaroAlt:   300 ft, Airspeed:  100 knts
 Heading Data
  True Heading: 125.0ø   Altitude above Ground: --- ft
```
ID-619279

**Figure 3012. (Sheet 1 of 1) "ads" Command**

(4) "bit" Command

(a) This command displays BIT information about the health of the KGX. Refer to Figure 3013 for an example.

```
RANGR-XVR> bit
 BIT
 Temperature= 58.88 øC
 External Power= 23.25 V
 Internal Power= 5.05 V
 IC Power= 3.20 V
 RF Tx Pwr= 28.54 V

 POST ==> PASS
  RAM Verify....... P    SDRAM Verify..... P    Temp Sensor ..... P
  UART1 Loopback... P    UART2 Loopback... P    UART3 Loopback... P
  UART4 Loopback... P    UART5 Loopback... P    UART6 Loopback... P
  ARINC1 Loopback.. P    ARINC2 Loopback.. P
  PM/Checksum.... w/w    Cnfg/Checksum.. P/P    Calibration...... P
  Tx Pwr Control... P    Tx Synthesizer... P    Tx Modulator..... P
  FPGA Enabled..... P    FPGA Data Bus.... P    Rx Synthesizer... P

 PBIT ==> PASS
  Valid Address.... P    Temperature...... P    Input DC Power... G
  GPS Data Good.... P    GPS PPS Good..... G    GPS Comm Good.... P
  GPS Ant Open..... W    GPS Ant Short.... G
  ADS Data Good.... W    ADS Comm Good.... W
  Tx Msg Good...... P    Tx PLL Lock...... P    TX PS Good....... P
  UAT Tx Power..... G    BroadcastMonitor. P    Nominal Msg Rate. P
  Rx Own Msg....... P    Rx PLL Lock...... P
  Top Antenna...... P    Bottom Antenna... P
```
ID-619280

**Figure 3013. (Sheet 1 of 1) "bit" Command**

(5) "comm" Command

(a) This command continually displays serial port communication status information:
- Enabled/disabled status
- Receive and transmit byte count and errors.

(b) The data is updated once for each second. Refer to Figure 3014 for an example.

(c) Type the "stop" command to stop updating and return to the prompt.

```
Serial Comm:
Port   Status     Baud(Set/Act) P  Rx Count   Tx Count   RxErr   TxErr
---------------------------------------------------------------------
 1     ENABLED     19200/ 19345 N  1264804         43        0       0
 2     DISABLED   115200/116071 N        2          2        0       0
 3     ENABLED     38400/ 38385 O   196104     149566        0       0
 4     DISABLED   115200/115205 N        2          2        0       0
 5     ENABLED    115200/115205 N      474     397291        0       0
 6     DISABLED   115200/115205 N        2          2        0       0

ARINC Comm:
Port   Status   Speed   Rx Count   Tx Count
--------------------------------------------
IN1    DISABLED high       24364        0
IN2    DISABLED high           0        0
OUT1   DISABLED high           0        1
```
ID-619281

**Figure 3014. (Sheet 1 of 1) "comm" Command**

(6)   "control" Command

(a)   This command displays the control, squawk and mode status including the squawk code, IDENT status, altitude control status, call sign, transmit control status and vertical status.  Refer to Figure 3015.



```
RANGR-XVR> control

 Squawk: 1200, IDENT OFF, ALT Transmit, Tx ON, AIRBORNE,
 CallSign: , Emergency: 0- None
```
ID-520115

**Figure 3015. (Sheet 1 of 1) "control" Command**

(7)   "gps" Command

(a)   This command displays data which is being received from the GPS input.  Refer to Figure 3016.



```
GPS Info

Configuration: Internal GPS - gamma1, 19200
Source:  Serial - FFS/Chelton
SWVer: 1.11

Date:  2/29/2016  UTC Time: 22:23:55 (80635)
 Mode    Latitude    Longitude Altft Vknt:NS     EW   GSpd    Track   Vvelfpm
 SBAS  32.916980N  96.986410W   129    -0.1    -0.1    0.2 -117.760     -8.9

   HIL (NIC)     HFOM(NACp)    VFOM(GVA)    VHFOM(NACv)      VVFOM      VIL
  141.6m( 8)      1.0m(11)     1.00m(2)     0.49m/s(3)     0.62m/s   246.27m

Message Counts:
 Msgs: 18728  Nav:  3357  Status:  3369  Aux:  3369  Ver:  3367  Other:  3400

Status
 Comm:1  Valid:1  Lat:1  Lon:1  FDE:0  SBAS:1  SATu: 0
 Fail:0  NoWAAS:0  newASS:0  neSAT:0  Ex:0  Ao:1  As:0  SR:0  Osc:0  PL:0
 RTC:0  sbasH:0  ALM:1  RF:0  EEPROM:0  SDRAM:0  Step:0
```
ID-619282

**Figure 3016. (Sheet 1 of 1) "gps" Command**

(8)   "info" Command

(a)   This command displays information such as serial number, operation time and hardware and software version information about the KGX. Refer to Figure 3017 for an example.

```
RANGR-XVR> info

RANGR-XVR, Internal Beta1 GPS
    Serial Number........ 1305x066
    Operation Time....... 112.5 hrs
    HW Version........... 4.11
    Boot Version......... 1.0.1.80
    Boot Checksum........ 0xE18AD740
    Boot Build Time...... 07/20/2014 20:11:20
    SW Version........... 1.11.1.95
    SW Checksum.......... 0xFD68022D
    SW Build Time........ 03/30/2016 17:45:50
    FPGA Version......... 1.3
    FPGA Build ID........ 0x520F155E
    FPGA Build Time...... 05/04/2015 15:11:40
    GPS Version.......... 1.11
    GPS CRC.............. 0x65602F3A
```

**Figure 3017. (Sheet 1 of 1) "info" Command**

(9)   "Reset" Command

(a)   This command causes the KGX to restart. Refer to Figure 3018.

(b)   Push the <Enter> key three times to return to the maintenance interface.

```
RANGR-XVR> Reset
5
```

**Figure 3018. (Sheet 1 of 1) "Reset" Command**

(10)  "rxstatus" Command

(a)   This command displays detailed status and other information about the ADS-B data being received by the KGX. Refer to Figure 3019 for an example of the output.

(b)   The output displayed contains an initial section with general count information (current UTC second, receiver loop count, and receiver word count). These counts will increment at varying rates when the receiver is operating correctly.

(c)   The next rxstatus output section displays general message count information for ground Uplink, basic, and long message types. The displayed counts include total messages received (Total), messages received in the last second (LstSec) and messages with various counts of corrected Reed-Solomon errors (RSErr: x).

(d)   The third rxstatus section displays detailed traffic information. This information includes total number of traffic targets being tracked and then detailed information about the ownship data being received and the 10 closest traffic targets. The detailed traffic information includes address (Addr), address type (Typ), call sign, latitude, longitude, altitude in feet (Alt), speed in knots (Spd), air ground status (AG), message count (msgs), signal strength indication (SSI) in dBm, and traffic (TO) in seconds.

NOTE:   Traffic targets will time out being tracked if no ADS-B message is received from the target for more than 25 seconds.

(e)   The fourth rxstatus section displays detailed ground station information. This information includes total number of ground stations being received and detailed information about the 10 closest ground stations. The detailed ground station information includes Latitude, Longitude, Site ID, time slot of last transmission, message count (Msgs), SSI in dBm, and ground station TO in seconds.

NOTE: Ground stations will time out being tracked if no ADS-B uplink message is received from the ground station for more than 40 seconds.

(f) Type the "stop" command to stop updating rxstatus and return to the prompt.

```
UTC Sec:          55950

Msgs Rxd:   Total   LstSec  RSErr:1    2     3     4     5     6    >6    Ovr
-------------------------------------------------------------------------------
 Uplink        0       0       0      0     0     0     0     0     0      0
 Basic       954       1      25      8     8     7     4     9     0      0
 Long       1668       3      25     23     1     7     2     4     5      0
 1090ES        0       0       0                                          0

Traffic:  4  Tracks:  4  TCAS:  0  NBAir: 2  Air:  2  Gnd:  0  Other:  2
  #   Addr Typ Callsign   Latitude    Longitude    Alt    Spd G  Msgs  SSI   Range TO
-------------------------------------------------------------------------------
OWN   FF00 ABi FXVRGA    32.917140N  96.986580W    ---     0 A     0    0    0ft  0s
  1   2456 ABi BILL1234  32.917140N  96.986580W    450     0 A   454  -21   48ft 24s
  2 ADFBA2 ABi GNDTEST   32.917100N  96.986490W    375     0 A     3  -20  127ft 24s
  3 BB2345 ABi BILL001   31.999870N  96.000170W    ---   --- A   523  -20  74.3nm 24s
  4 B528C9 ABi 00000000  --.-----0?  --.-----0?    ---   --- A   889  -21   ---nm  4s
  5
  6
  7
  8
  9
 10

Ground Stations:    0  Service Status: 0
  #    Latitude   Longitude Site Slt   Msgs SSI SS   Range TO
-------------------------------------------------------------------------------
  1
  2
  3
  4
  5
  6
  7
  8
  9
 10
```

ID-613115

**Figure 3019. (Sheet 1 of 1) "rxstatus" Command**

(11) "cnfg" Command

(a) This command displays configurable information such as the serial port settings (protocol and baud rate), the ICAO address, and the VFR call sign. Refer to Figure 3020.

```
RANGR-XVR> cnfg

 Configuration Settings  (Lcl:YES/VALID, PM:NO/INVALID):
 ICAO Address.............. FF00
 VFR Call Sign............. FXVRGA
 GPS Config................ Level C
 NACv Mode................. Auto (from GPS)
 Receiver Capability....... no1090, 978
 Emit Category............. LIGHT AIRCRAFT
 Squat Mode................ none
 Groundspeed Threshold..... 0 knots
 Vehicle Size.............. Length=0 meters, Width=0 meters
 UAT Ant................... bottom, No DC Gnd Chk
 GPS Ant Offset............ Long=No Data, Lateral=No Data
 Mode A Rx................. disable
 Disable Squawk Tx......... off
 Max Targets............... max
 Chelton CSA Enable........ disable
 Traffic Vel Validation.... enable
 Display Data Output....... traffic&fisb
 Serial In  1.............. Internal-GPS, 19200
 Serial In  2.............. UNUSED, 9600
 Serial Out 2.............. UNUSED, 9600
 Serial In  3.............. TMAP, 38400
 Serial Out 3.............. TMAP, 38400
 Serial In  4.............. UNUSED, 9600
 Serial In  5.............. MAINT, 115200
 Serial Out 5.............. MAINT, 115200
 Serial In  6.............. UNUSED, 9600 (RS-422)
 Serial Out 6.............. UNUSED, 9600 (RS-422)
 ARINC In 1................ UNUSED, low
 ARINC In 2................ UNUSED, low
 ARINC Out 1............... UNUSED, low
```

ID-619284

**Figure 3020. (Sheet 1 of 1) "cnfg" Command**

(12) "set" Command

    (a) This command is used to modify configuration settings such as ICAO address, call sign, and serial port function. Help on this command is displayed by entering "set ?". Example "set ?" output is shown in Figure 3021.

```
RANGR-XVR> set ?

 USAGE: set <item>

  <item>        Configuration items:
  ?                                This help
  addr <hex>                       ICAO address (6 hex characters)
  call sign <string>               VFR default call sign (8 characters)
  gps <sda>                        GPS System Design Assurance
  nacv <val>                       GPS NACv mode
  rx <cap>                         Receiver capability
  emit cat <num>                   Emitter category number
  squat <opt>                      Squat switch option (none, low, or high)
  threshold <num>                  ON GROUND groundspeed threshold
  acsize <len> <width>             Vehicle length and width
  uatant <opt> <dcgnd>             UAT antenna mode and DC ground check
  gpsant <lon> <lat>               GPS antenna offset
  modeArx <opt>                    Mode A receive
  disableSquawkTx <opt>            Disable transmit squawk/flight plan id
  max trgs <opt>                   Maximum number of targets displayed
  cheltonCSA <opt>                 Enable CSA for Chelton
  trafVelVal <opt>                 Disable traffic velocity validation
  displayout <opt>                 Display Output Data
  serial <dir> <port> <func> <baud>  Serial port function protocol & baud rate
  arinc <dir> <port> <func> <speed>  ARINC port protocol & speed
```

ID-619285

**Figure 3021. (Sheet 1 of 1) "set" Command**

(13) "cnfg defaults" Command

    (a) This command resets all configuration values to default factory settings. Refer to Figure 3022.

```
RANGR-RX> cnfg defaults
Configuration Reset to defaults
RANGR-RX>
```

ID-520123

**Figure 3022. (Sheet 1 of 1) "cnfg defaults" Command**

**D.** **Serial and ARINC Port Settings**

    (1) This section describes the configuration settings for serial and ARINC port functionality.

    (2) "set serial in" Command

        (a) This command sets the serial port input configuration options. Help on this command is displayed by entering "set serial in ?". Refer to Figure 3023 for an example.

            NOTE:    Refer to Paragraph 3.C. , Step (3) for information on selecting serial input settings.

```
RANGR-XVR> set serial in ?

 USAGE: set serial in <port> <func> <baud> <hwtype>

  <port>      Serial port number:  1, 2, 3, 4, 5, 6,

  <func>      Interface function/protocol:
              Port 1:
                 UNUSED, GPS-FFS, GPS-ADSBPlus, Internal-GPS,
              Port 2:
                 UNUSED, GPS-FFS, GPS-ADSBPlus, ADS, Alt-Encoder,
                 GSL-71, GTX-Remote, Disp-Ctrl,
              Port 3:
                 MAINT, TC-Control, TC-Monitor, TC-Out, UNUSED,
                 TMAP, Disp-Ctrl,
              Port 4:
                 UNUSED, GPS-FFS, GPS-KSN, GPS-ADSBPlus, ADS, Alt-Encoder,
                 GSL-71, GTX-Remote,
              Port 5:
                 MAINT, UNUSED, Disp-Ctrl,
              Port 6:
                 UNUSED, GPS-FFS, GPS-KSN, GPS-ADSBPlus, ADS, Alt-Encoder,
                 GSL-71, Disp-Ctrl,

  <baud>      4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800,

  <hwtype>    RS-232, RS-422,   (Port 6 ONLY)

RANGR-XVR> set serial in 1 Internal-GPS
 Serial In  1.............. Internal-GPS, 19200
RANGR-XVR>
```
ID-619286

**Figure 3023. (Sheet 1 of 1) "set serial in" Command**

(3) "set serial out" Command

(a) This command sets the serial port output configuration options. Help on this command is displayed by entering "set serial out ?". Refer to Figure 3024 for an example.

NOTE: Refer to Paragraph 3.C. Step (3) for information on selecting serial output settings.

NOTE: Serial Port 4 is input ONLY and does not accept output settings.

```
RANGR-XVR> set serial out ?

 USAGE: set serial out <port> <func> <baud> <hwtype>

  <port>      Serial port number:  2, 3, 5, 6,

  <func>      Interface function/protocol:
              Port 2:
                UNUSED, Alt-Encoder, Traffic-Alert, Pass-Thru,
                Xpndr-Monitor, MX-20,
              Port 3:
                MAINT, TC-Control, TC-Monitor, TC-Out, UNUSED,
                TMAP, Traffic-Alert, Pass-Thru, MX-20,
              Port 5:
                MAINT, UNUSED, Traffic-Alert, Pass-Thru, MX-20,
              Port 6:
                UNUSED, Alt-Encoder, Traffic-Alert, Pass-Thru,
                Xpndr-Monitor, MX-20,

  <baud>      4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800,

  <hwtype>    RS-232, RS-422,  (Port 6 ONLY)

RANGR-XVR> set serial out 6 MX-20 38400 RS-422
 Serial In  6.............. UNUSED, 38400 (RS-422)
 Serial Out 6.............. MX-20, 38400 (RS-422)
```

ID-619287

**Figure 3024. (Sheet 1 of 1) "set serial out" Command**

(4)   "set arinc in" Command

(a)   This command sets the ARINC 429 input configuration for Ports 1 and 2. Refer to Figure 3025 for an example.

NOTE:   Refer to Paragraph 3.C. , Step (4) for information on selecting ARINC input settings.

```
RANGR-XVR> set arinc in ?

 USAGE: set arinc in <port> <func> <speed>

  <port>      ARINC port number:   1, 2,

  <func>      Interface function/protocol:
              Port 1:
                  UNUSED,
                  GPS-743,
                  ADC,
                  AHRS,
                  ADC&AHRS,
                  Transpndr-Cntrl,
                  Traffic,
                  GPS-PRAIM-743,
              Port 2:
                  UNUSED,
                  GPS-743,
                  ADC,
                  AHRS,
                  ADC&AHRS,
                  Transpndr-Cntrl,
                  Traffic,
                  GPS-PRAIM-743,

  <speed>     Speed: low, high

RANGR-XVR> set arinc in 1 GPS-743 low
 ARINC In 1................ GPS-743, low
```

ID-619288

**Figure 3025. (Sheet 1 of 1) "set arinc in" Command**

(5)   "set arinc out" Command

(a)   This command sets the ARINC 429 output configuration for Port 1. Note that there is only one ARINC 429 output port. Refer to Figure 3026 for an example.

NOTE:   Refer to Paragraph 3.C. , Step (5) for information on selecting ARINC output settings.

```
RANGR-XVR> set arinc out ?

 CMND ERR: Invalid command

RANGR-XVR> set arinc out ?

 USAGE: set arinc out <port> <func> <speed>

  <port>      ARINC port number:  1,

  <func>      Interface function/protocol:
              Port 1:
                  UNUSED, GPS-743,
                  Traffic,

  <speed>     Speed: low, high

 ARINC Out 1............... UNUSED, low
RANGR-XVR> set arinc out 1 Traffic high
 ARINC Out 1.............. Traffic, high
```

ID-619289

**Figure 3026. (Sheet 1 of 1) "set arinc out" Command**

### E. ADS-B Transmit Settings

(1) This section describes configuration settings mainly for transmitting ADS-B messages. Some of these settings are relevant for receiver only units as well.

(2) "set addr" Command

(a) This command is used to set the ICAO address of the aircraft. For example, to set the ICAO address to ABCD12, enter "set addr ABCD12". The ICAO address must be entered as a hex value. The KGX requires the ICAO to be set to the aircraft's registered ICAO address. This must be set for all KGX products. Refer to Figure 3027.

```
RANGR-XVR> set addr ?

 USAGE: set addr <chars>

  <hex>      ICAO address - up to 6 hexidecimal characters (0-9 & A-F)

RANGR-XVR> set addr ABCD12
 ICAO Address.............. ABCD12
```
ID-520129

**Figure 3027. (Sheet 1 of 1) "set addr" Command**

(3) "set call sign" Command

(a) This command sets the default call sign of the aircraft and is typically the aircraft tail number. For example, to set the call sign to ABCD1234, enter "set call sign ABCD1234". The default call sign is transmitted by a transceiver if a call sign setting is not received from a configured transmit controller (transponder, KGX control panel, etc.). In a receiver, the default call sign is for informational purposes only. Refer to Figure 3028.

```
RANGR-RX> set call sign ?

 USAGE: set call sign <chars>

  <chars>    Default Call Sign - 8 characters (0-9 & A-Z)

RANGR-RX> set call sign 12345678
 VFR Call Sign............. 12345678
```
ID-520130

**Figure 3028. (Sheet 1 of 1) "call sign" Command**

(4) "set gps" Command

(a) This command sets the system design assurance level for the GPS input. Internal GPS must be set to Level C. For external GPS units refer to the GPS manufacturer's data for setting system design assurance level. This must be set for all KGX products. Refer to Figure 3029.

```
RANGR-XVR> set gps ?

 USAGE: set gps <opt>

  <opt>      GPS SW design assurance level:
             U, D, C, B,

RANGR-XVR> set gps C
 GPS Config............... Level C
```
ID-520131

**Figure 3029. (Sheet 1 of 1) "set gps" Command**

(5) "set nacv" Command

    (a) This command sets the Navigation Accuracy Category for velocity (NACv) for the GPS input. Internal GPS must be set to 3 (auto). For external GPS units, refer to the GPS manufacturer's data for setting NACv. This must be set for all KGX products. Refer to Figure 3030.

```
RANGR-XVR> set nacv ?

 USAGE: set nacv <num>

  <num>        NACv mode number for GPS:
               0 : UNKNOWN
               1 : <10 m/s
               2 : <3 m/s
               3 : Auto (from GPS)

RANGR-XVR> set nacv 2
 NACv Mode................. <3 m/s
RANGR-XVR>
```
ID-520132

**Figure 3030. (Sheet 1 of 1) "set nacv" Command**

(6) "set rx" Command

    (a) This command sets the receiver installed options to be transmitted by a transceiver. Transceivers must be set to 978 and no1090. It is not necessary to set this for a receiver only. Refer to Figure 3031.

```
RANGR-XVR> set rx ?

 USAGE: set rx <opt>

  <opt>        ADS-B Receiver Capabilities:
               no1090, 1090, no978, 978,

RANGR-XVR> set rx no1090 978
 Receiver Capability....... no1090, 978
```
ID-619290

**Figure 3031. (Sheet 1 of 1) "set rx" Command**

(7) "set emit cat" Command

    (a) This command sets the emitter category of the aircraft and must be set to something other than the default of 0 (no aircraft type). This must be set for all KGX products. Refer to Figure 3032.

```
RANGR-XVR> set emit cat ?

 USAGE: set emit cat <num>

   <num>      Vehicle emitter category number:

              0 :   NO AIRCRAFT TYPE
              1 :   LIGHT AIRCRAFT
              2 :   SMALL AIRCRAFT
              3 :   LARGE AIRCRAFT
              4 :   HIGH VORTEX LARGE
              5 :   HEAVY AIRCRAFT
              6 :   HIGH PERFORM AC
              7 :   ROTORCRAFT
              9 :   GLIDER/SAIL
             10 :   LIGHTER THAN AIR
             12 :   ULTRALIGHT/HG
             14 :   UAV

 Emit Category............. NO AIRCRAFT TYPE
RANGR-XVR> set emit cat 1
 Emit Category............. LIGHT AIRCRAFT
RANGR-XVR>
```

ID-619291

**Figure 3032. (Sheet 1 of 1) "set emit cat" Command**

(8)   "set squat" Command

(a)   This command sets the active state (low or high) for the squat switch of the aircraft or to indicate there is no active squat switch. The squat switch (or other air/ground determination discrete) is an automatic means to indicate when the aircraft is on the ground or in the air. This must be set for all KGX products. Refer to Figure 3033.

```
RANGR-XVR> set squat ?

 USAGE: set squat <opt>

   <opt>      squat switch configuration:
              none   No squat switch input
              low    Low input for ON GROUND
              high   High input for ON GROUND

RANGR-XVR> set squat low
 Squat Mode............... low
```

ID-520135

**Figure 3033. (Sheet 1 of 1) "set squat" Command**

(9)   "set threshold" Command

(a)   This command sets the groundspeed threshold which is used to determine when the aircraft is on the ground if an automatic means (squat switch) is not configured for the Light Aircraft (1) Emitter Category only. A groundspeed of less than the threshold indicates the aircraft is on the ground. Refer to Figure 3034.

```
RANGR-XVR> set threshold ?

 USAGE: set threshold <knts>

  <knts>     Groundspeed threshold for Air/Gnd switching:
           0, 30, 40, 50, 60, 70, 80, 90, 100, 120,

  NOTE: Groundspeed threshold for   (1) LIGHT AIRCRAFT Emit Category only

RANGR-XVR> set threshold 30
 Groundspeed Threshold.....  30 knots
```

ID-607680

**Figure 3034. (Sheet 1 of 1) "set threshold" Command**

(10) "set acsize" Command

    (a) This command sets the aircraft size that is used to set the aircraft size code transmitted by the transceiver. Setting this parameter is only required for transceivers. Refer to Figure 3035.

```
RANGR-XVR> set acsize ?

 USAGE: set acsize <len> <width>

  <len>      Aircraft length in meters (0-90)

  <width>    Aircraft width in meters (0-90)

  NOTE: Odd values are rounded down to nearest even meter

RANGR-XVR> set acsize 20 50
 Vehicle Size............. Length=20 meters, Width=50 meters
```

ID-619292

**Figure 3035. (Sheet 1 of 1) "set acsize" Command**

(11) "set uatant" Command

    (a) This command sets the UAT antenna configuration. This must be set for all KGX products. Refer to Figure 3036.

```
RANGR-XVR> set uatant ?

 USAGE: set uatant <opt> <dcgnd>

  <opt>      Antenna configuration:   dual, top, bottom

  <dcgnd>    Antenna DC ground check:  nochk, check

RANGR-XVR> set uatant dual nochk
 UAT Ant................. dual, No DC Gnd Chk
```

ID-615919

**Figure 3036. (Sheet 1 of 1) "set uatant" Command**

(12) "set gpsant" Command

    (a) This command sets the GPS antenna configuration. This must be set for transceivers. Refer to Figure 3037.

```
RANGR-XVR> set gpsant ?

 USAGE: set gpsant <lon> <lat>

  <lon>      GPS antenna longitudinal offset:
              0 : No Data
              1 : Offset Applied by Sensor
              2-60 : Distance from AC nose in even valued meters

  <lat>      GPS antenna lateral offset:
              0 : No Data
              1 : Left 2 meters
              2 : Left 4 meters
              3 : Left 6+ meters
              4 : Center
              5 : Right 2 meters
              6 : Right 4 meters
              7 : Right 6+ meters

RANGR-XVR> set gpsant 2 4
 GPS Ant Offset............ Long=2 meters, Lateral=Center
```

ID-619293

**Figure 3037. (Sheet 1 of 1) "set gpsant" Command**

(13) "set modeArx" Command

(a) This command enables/disables Mode A code reception from the on-aircraft Mode A/C transponder. When enabled Flight Plan ID (squawk code) and IDENT are received from the on aircraft's Mode A/C transponder through its RF transmissions. The default setting is "disable". This is only used with transceivers and must not be set in receiver only units. This should be set to "enable" if using the external or internal Xpndr-Monitor functions. Refer to Figure 3038.

```
RANGR-XVR> set modeArx ?

 USAGE: set modeArx <opt>

  <opt>      enable, disable

RANGR-XVR> set modeArx enable
 Mode A Rx................ enable
```

ID-520140

**Figure 3038. (Sheet 1 of 1) "set modeArx" Command**

(14) "set disableSquawkTx" Command

(a) This command disables the squawk code transmissions over the UAT datalink when set to "on". This setting must not be set to "on" and left to the default "off" setting. This is only used with transceivers and must not be set in receiver only units. Refer to Figure 3039.

```
set disableSquawkTx ?

 USAGE: set disableSquawkTx <opt>

   <opt>      on, off

RANGR-XVR> set disableSquawkTx on
 Disable Squawk Tx......... on
RANGR-XVR>
```
ID-520141

**Figure 3039. (Sheet 1 of 1) "set disableSquawkTx" Command**

**F.    Display Output Settings**

(1)   This section describes configuration settings for controlling traffic display output typically for legacy displays.

(2)   "set max trgs" Command

(a)   This command sets the maximum number of targets to be sent on any configured serial or ARINC 429 port configured for traffic display output. This is typically used to limit the number of traffic targets for displays that can't process a large number of traffic targets. Refer to Figure 3040.

```
RANGR-XVR> set max trgs ?

 USAGE: set max trgs <num>

  <num>      8-30, max

 Max Targets............... max
RANGR-XVR> set max trgs 30
 Max Targets............... 30
RANGR-XVR>
```
ID-619294

**Figure 3040. (Sheet 1 of 1) "set max trgs" Command**

(3)   "set cheltonCSA" Command

(a)   This command enables/disables the (Conflict Situational Awareness) CSA bit in the Heartbeat message of the "Traffic-Alert" protocol. This parameter defaults to "disable" and must ONLY be set to "enable" when interfacing to a Chelton FlightLogic Display. The legacy Chelton display is not TSO-C195a compliant and requires this Heartbeat message bit to be set or it will generate an ADS-B failure. The KGX does not implement a Conflict Situation Awareness (CSA) algorithm since DO-217A and TSO-C195a do not currently specify any CSA applications. For all other displays leave this parameter at the default setting of "disable". Refer to Figure 3041.

```
RANGR-XVR> set cheltonCSA ?

 USAGE: set cheltonCSA <opt>

   <opt>      enable, disable

RANGR-XVR> set cheltonCSA enable
 Chelton CSA Enable........ enable
```
ID-520143

**Figure 3041. (Sheet 1 of 1) "set cheltonCSA" Command**

(4) "set trafVelVal" Command

(a) This command enables/disables the DO-317A/TSO-C195a Traffic Velocity Validation\Invalidation of legacy ADS-B Transmitters that transmit NACv values of 0. This parameter defaults to "enable" and must ONLY be set to "disable" when interfacing to legacy displays that are (1) not TSO-C195a compliant and (2) do not adequately display non-directional traffic symbols. Several non-TSO-C195a displays adequately display non-directional traffic and do not require velocity validation/invalidation to be disabled.

(b) The legacy MX-20 Display does not support non-directional traffic symbols and instead displays a directional traffic symbol pointing at approximately 120 degrees from North. For compatibility with the ADS-B system, the traffic velocity validation should be set to "enable" for this display.

(c) The KGX attempts to validate NACv=0 velocities in accordance with DO-317A/TSO-C195a but some traffic states (low-speed ground) will still cause the NACv=0 track velocities to be invalidated and sent to the display as non-directional traffic. Setting this parameter to "disable" turns off all DO-317A/TSO-C195a velocity validation/invalidation and passes the track's velocity data to the display as directional traffic. This parameter must only be set to "disable" for legacy non-TSO-C195a displays without non-directional traffic symbols when occasional display of non-directional traffic is deemed to be unacceptable or misleading. Otherwise leave this parameter at the default setting of "enable". Refer to Figure 3042.

```
RANGR-XVR> set trafVelVal ?

 USAGE: set velValDisable <opt>

  <opt>      enable, disable

RANGR-XVR> set trafVelVal enable
 Traffic Vel Validation.... enable
```

ID-520144

**Figure 3042. (Sheet 1 of 1) "set trafVelVal" Command**

(5) "set displayout"

(a) "trafficOnly" provides traffic information to the display (position, ground track, etc.) but no weather or other flight information.

(b) "fisbOnly" provides weather and flight information (NOTAMS, TFRs, ATIS, etc.) but no traffic.

(c) "traffic&fisb" provides traffic, weather, and flight information simultaneously.

(d) This command allows the installer to set the type of data to be sent to the display. The installer can configure the KGX to output traffic only, FISB only, or both. By default, the KGX outputs the traffic and FISB data to the display. Refer to Figure 3043.

```
RANGR-XVR> set displayout ?
 USAGE: set displayout <opt>
  <opt>      traffic&fisb, fisbOnly, trafficonly,
RANGR-XVR> set displayout traffic&fisb
 Display Data Output....... traffic&fisb
```

ID-607681

**Figure 3043. (Sheet 1 of 1) "set displayout" Command**

**G. Terminal Maintenance Port Interface Security**

(1) General

    (a) The KGX provides additional security features to prevent unauthorized access to the maintenance port interface. Installers now have the option to set a password to restrict access.

    (b) In order to use the commands, the installer must have access to the MPI through a terminal interface, either through a PC using Tera Term, or using the ADS-B MPI App with a WiFi connection.

    (c) Refer to Table 3024 for a list of commands.

**Table 3024.  ARINC 429 Port Output Speed Configuration Settings**

| Command | Description |
|---|---|
| setpw <password> | Sets the password to access the KGX MPI |
| checkpw <password> | Verifies the password while in the MPI |
| resetpw | Removes password protection from MPI |
| maint ascii pw <password> | Command to access the MPI with a set password |

    NOTE:    The MPI security settings are not accessible through the KGX control panel.

(2) "setpw" Command (refer to Figure 3044)

    (a) This command allows the installer to set a password in order to access the MPI. The password goes into effect once the unit is reset, and prevents access until the correct password is entered.

    (b) Passwords are case sensitive, and any combination of printable ASCII characters, including symbols and spaces, can be used. Passwords are limited to between 1 and 30 characters in length, and cannot start with a space. However, spaces can be used between characters and at the end of passwords. Extended ASCII characters are not supported.

    (c) After entering a password, the KGX asks for confirmation. Re-enter the password to complete the setpw command.

    (d) Until the unit is reset, the KGX will continue to allow configuration access without requiring the password to be entered.

```
RANGR-XVR> setpw FreeFlight Systems
   Confirm Password:  FreeFlight Systems
Set!! PW REQUIRED to enter Maintenance Mode!
RANGR-XVR>
```
ID-607682

**Figure 3044. (Sheet 1 of 1) "setpw" Command**

(3) "checkpw" Command (refer to Figure 3045)

    (a) This command is used to verify the password before resetting the system.

```
RANGR-XVR> checkpw Freeflight Systems

 Invalid PW!

 MAINT LOCKED OUT -

RANGR-XVR> checkpw FreeFlight Systems

 valid PW!
RANGR-XVR>
```

**Figure 3045. (Sheet 1 of 1) "checkpw" Command**

(4)    "resetpw" Command (refer to Figure 3047)

   (a)    This command is used to remove password protection from the MPI.

```
RANGR-XVR> resetpw

 PW RESET and disabled for Maintenance Mode!
RANGR-XVR>
```

**Figure 3046. (Sheet 1 of 1) "resetpw" Command**

(5)    "maint ascii pw" Command (refer to Figure 3047)

   (a)    Once a password has been set, pressing the Enter button three times no longer removes the maintenance lockout.  It will instead display a message, "MAINT LOCKED OUT - PW PROTECTION".  This continues to display until the command "maint ascii pw <password>" is entered correctly into the terminal to gain access to the MPI.

```
 MAINT LOCKED OUT - PW PROTECTION
maint ascii pw 1234
 Invalid PW!

 MAINT LOCKED OUT - PW PROTECTION
maint ascii pw FreeFlight Systems
 Valid PW!

RANGR-XVR>
```

**Figure 3047. (Sheet 1 of 1) "maint ascii pw" Command**

(6)    Resetting Forgotten Password

   (a)    In the case where a password is lost or unknown, the following reset procedure must be performed which requires access to the physical unit.  This removes the password protection from the MPI and allows normal access.

      1    Remove power from the KGX.

      2    Ground Pins J1-12 (Anonymous Mode), J1-15 (Traffic Test), J1-27 (Air/Gnd).

      3    Apply power to the KGX, and turn on by grounding J1-32 (Remote On).

      4    Enter the command "maint ascii pwreset" into the terminal.

## 5.    Configuration and Setup using the KGX Control Panel

   A.    **General**

   (1)    The system must be configured during initial system installation by a qualified technician. Table 3001 must be used to document the system installation for future reference. To view or change these settings you must enter the KGX control panel configuration mode.

   NOTE:    The configuration setup screen is the first thing displayed on startup when a completely new KGX is installed and powered up for the first time.  After a configuration has been programmed, the system will power up in normal operating mode and the configuration is stored in the KGX.

**B. Entering Configuration Mode**

CAUTION:    DO NOT USE CONFIGURATION MODE IN FLIGHT.

(1)  To enter configuration mode on the KGX control panel, complete the following steps:

(a)  Hold down the FN button while turning the mode selection knob from OFF to any operating mode.

(b)  In the configuration mode the KGX control panel displays the messages on the screen as shown in Figure 3048. Software versions shown can be the same or later depending on the actual version of software installed.

```
┌────────────────┐
│   CONTROLLER   │
│     V1.14      │
└────────────────┘


┌────────────────┐
│   HW V4.0      │
│   SW V1.9      │
│   FPGA V1.2    │
└────────────────┘


┌────────────────┐
│  SETUP AND     │
│  TEST MODE.    │
│  PRESS ENT TO  │
│  PROCEED       │
└────────────────┘
```
ID-520156
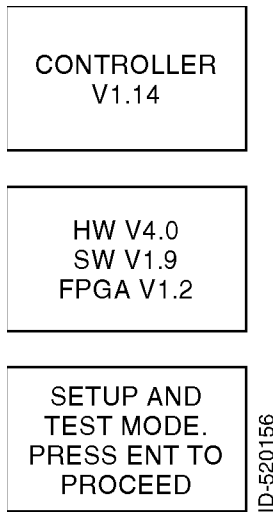
**Figure 3048. (Sheet 1 of 1) Configuration Mode Display**

**C. Configuration Mode Operation**

(1)  General

(a)  Configuration items can be changed using the CODE knob and the ENT button. Pressing FN advances to the next configuration item.

(b)  The following paragraphs detail the setup modes available for configuring the KGX.

(2)  Aircraft Mode S (or ICAO) Address

(a)  The Mode S address is a 24-bit number assigned to the aircraft and is represented in a 6-character hexadecimal format. The rotary CODE knob is used to change each character as required. Each character of the Mode S address is a number between 0 and 9 or a letter between A and F. When the ENT key is pressed the cursor advances to the next character as shown in Figure 3049.

(b)  To advance to the next configuration item without changing the ICAO address either scroll through the six characters by pressing the ENT key six times or press the FN key.

```
┌────────────────────┐   ┌────────────────────┐
│  Set Mode S Address│   │  Set Mode S Address│
│                    │   │                    │
│     500000         │   │     5A0000         │
└────────────────────┘   └────────────────────┘
```
ID-495122

**Figure 3049. (Sheet 1 of 1) Aircraft Mode S (or ICAO) Address Display**

(3)  VFR Squawk Code

    (a)  VFR squawk code is a preprogrammed default code when the pilot is flying VFR and not in contact with ATC. When the pilot presses the VFR button the VFR squawk code will replace the current squawk code. In the USA the VFR squawk code is 1200 and in most parts of Europe the VFR squawk code is 7000.
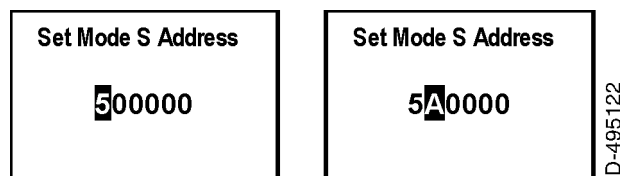
        NOTE:    The default VFR squawk code cannot be changed in flight and can only be set in the configuration mode.

    (b)  The VFR squawk code is a 12-bit number and is represented as a 4-character octal number. The rotary CODE knob is used to change each character as required. Each character of the squawk code is a number between 0 and 7. When the ENT key is pressed the cursor advances to the next character as shown in Figure 3050.

    (c)  To advance to the next configuration item without changing the VFR squawk code either scroll through the four characters by pressing the ENT key four times or press the FN key.
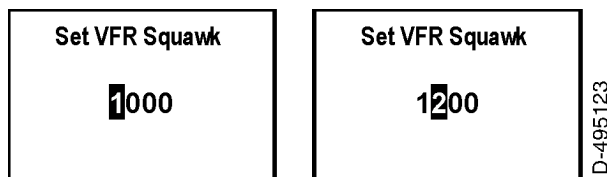


**Figure 3050. (Sheet 1 of 1) VFR Squawk Code Display**

(4)  Call Sign/VFR Flight ID

    (a)  The VFR flight ID (call sign) is usually one of the following types:

- Type A: The characters corresponding to the registration marking of the aircraft

- Type B: The telephony designator of the aircraft operating agency, followed by the last four characters of the registration marking of the aircraft

- Type C: The telephony designator of the aircraft operating agency, followed by the flight ID.

    (b)  The call sign/VFR flight ID is an eight character alpha-numeric string. The rotary CODE knob is used to change each character as required. Each character of the flight ID is a number between 0 and 9 and letter between A and Z. When the ENT key is pressed the cursor advances to the next character as shown in Figure 3051.

    (c)  To advance to the next configuration item without changing the VFR flight ID either scroll through the eight characters by pressing the ENT key eight times or press the FN key.

        NOTE:    The call sign/VFR flight ID cannot be changed in flight and can only be set in the configuration mode.
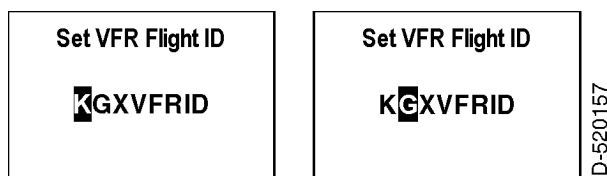


**Figure 3051. (Sheet 1 of 1) Call Sign/VFR Flight ID Display**

(5)  Groundspeed Threshold

    (a)  Groundspeed threshold can be used to help determine and verify the ON GROUND condition for transmitting ON GROUND ADS-B message types for "light fixed wing"

aircraft types only. The KGX uses the groundspeed threshold configuration to determine a maximum ON GROUND speed. There are 10 options to select groundspeed threshold:

- Unknown
- 30 knots
- 40 knots
- 50 knots
- 60 knots
- 70 knots
- 80 knots
- 90 knots
- 100 knots
- 120 knots.

NOTE: This only applies to an emitter category of light aircraft. No other categories use a configurable groundspeed threshold.

(b) The display screen is as shown in Figure 3052 with one of the options from above.

(c) Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the groundspeed threshold. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

```
Select Groundspeed
Threshold

50 knots
```
ID-495125

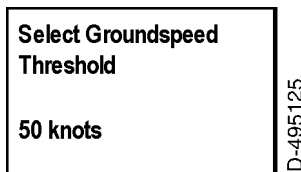**Figure 3052. (Sheet 1 of 1) Groundspeed Threshold Display**

(6) Aircraft (Emitter) Category

(a) The following options are offered for selecting aircraft (emitter) category:

- Unknown
- Light fixed wing
- Medium fixed wing
- Large fixed wing
- High vortex B757
- Heavy fixed wing
- High G/high speed
- Rotorcraft
- Glider/sailplane
- Lighter than air
- Parachutist
- ULM/hang/paraglider
- UAV.

(b) The display screen is as shown in Figure 3053 with one of the options from above.

(c) Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct aircraft category. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

Select Aircraft
Category

Light Fixed Wing

ID-495126

**Figure 3053. (Sheet 1 of 1) Aircraft (Emitter) Category Display**

(7) Squat Switch Type

(a) The following options are offered for selecting aircraft squat switch type:

- Not connected
- Low when ground
- Low when airborne.

(b) The display screen is as shown in Figure 3054 with one of the options from above.

(c) Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct squat switch type. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

Select Squat Switch
Type

Low when airborne

ID-495127
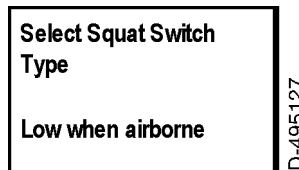
**Figure 3054. (Sheet 1 of 1) Squat Switch Type Display**

(8) Serial IN Channel X Data Type

NOTE: X = Channel number.

(a) The KGX can receive data through five serial channels. The following options are offered for selecting serial input type for each individual input serial channel of the KGX:

1 Channel 1:

NOTE: Refer to the GENERAL INFORMATION section for details on selecting serial input settings.

- Not used
- GPS-FreeFlight
- GPS-GNS ADS-B
- GPS internal.

2 Channel 2:

- Not used
- GPS-FreeFlight
- GPS-GNS ADS-B

- Air data computer

- Altitude encoder

- Control panel

- GTX remote

- TIS/FIS.

3    Channel 4:

- Not Used

- GPS-FreeFlight

- GPS-Aviation

- GPS-GNS ADS-B

- Air data computer

- Altitude encoder

- Control panel

- GTX remote.

4    Channel 5:

- Not Used

- TIS/FIS.

5    Channel 6:

- Not Used

- GPS-FreeFlight

- GPS-Aviation

- GPS-GNS ADS-B

- Air data computer

- Altitude encoder

- Control panel

- TIS/FIS.

(b)   The display screen is as shown in Figure 3055 with one of the options from above.

(c)   Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct serial input type. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

NOTE:    If "not used" is selected then the serial input line speed configuration mode will not be displayed and the next configuration mode item will be displayed.
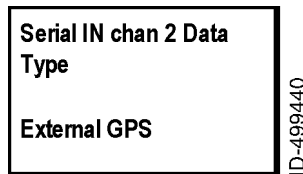
```
Serial IN chan 2 Data
Type

External GPS
```
ID-499440

**Figure 3055. (Sheet 1 of 1) Serial IN Channel X Data Type Display**

(9)   Serial IN Channel X Line Speed

NOTE:     X = Channel number.

(a)   The following options are offered for selecting the serial input baud rate for each channel data type:

- 4800

- 9600

- 19200

- 38400

- 57600

- 115200

- 230400.

(b)   The display screen is as shown in Figure 3056 with one of the options from above.

(c)   Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct serial input speed. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.
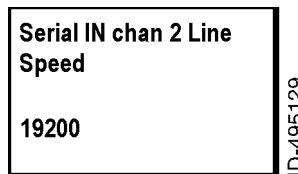


**Figure 3056. (Sheet 1 of 1) Serial IN Channel X Line Speed Display**

(10)  Serial OUT Channel X Data Type

NOTE:     X = Channel number.

(a)   The KGX can transmit data through two serial channels. The following options are offered for selecting serial output type for each individual channel of the KGX.

NOTE:     Refer to the GENERAL INFORMATION section for details on selecting serial output settings.

1     Channel 2:

- Not used

- Encoded altitude

- TIS/FIS

- ADS-B pass thru

- XPDR monitor

- MX-20.

NOTE:     XPDR monitor is only used in conjunction with FTM-190C, external Transponder Monitor.

2     Channel 5:

- Not used

- TIS/FIS

- ADS-B pass thru

- MX-20.

<u>3</u>    Channel 6:

- Not used

- Encoded altitude

- TIS/FIS

- ADS-B pass thru

- XPDR monitor

- MX-20.

<u>NOTE</u>:    XPDR monitor is only used in conjunction with FTM-190C, external Transponder Monitor.

(b)    The display screen is as shown in Figure 3057 with one of the options from above.

(c)    Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct serial output type. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

<u>NOTE</u>:    If "not used" is selected then the serial output line speed configuration mode is not displayed and the next configuration mode item is displayed.
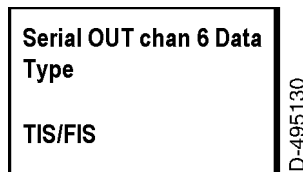


**Figure 3057. (Sheet 1 of 1) Serial OUT Channel X Data Type Display**

(11)  Serial OUT Channel X Line Speed

<u>NOTE</u>:    X = Channel number.

(a)    The following options are offered for selecting the serial output baud rate for each channel data type:

- 4800

- 9600

- 19200

- 38400

- 57600

- 115200

- 230400.

(b)    The display screen is as shown in Figure 3058 with one of the options from above.

(c)    Rotate the CODE knob either clockwise or counterclockwise to display the options mentioned above and select the correct serial output speed. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

Serial OUT chan 2 Line
Speed

19200

ID-495131

**Figure 3058. (Sheet 1 of 1) Serial OUT Channel X Line Speed Display**

(12) ARINC IN Channel X Data Type

NOTE: X = Channel number.

(a) The KGX can receive data through two ARINC 429 input channels. The following options are offered for selecting ARINC 429 input type for each individual channel of the KGX:

- Not used

- GPS

- Air data computer

- AHRS

- ADC+AHRS

- Txpdr Control

- Other 1

- Other 2.

NOTE: Refer to Paragraph 3.C. Step (4) in the CONFIGURATION, CALIBRATION, AND CHECKOUT section for information on selecting ARINC input settings.

(b) The display screen is as shown in Figure 3059 with one of the options from above.

(c) Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct ARINC input type. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

NOTE: If "Not Used" is selected then the ARINC input line speed configuration mode will not be displayed and the next configuration mode item will be displayed.
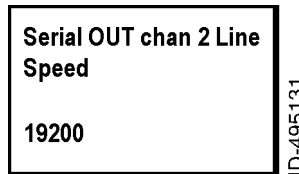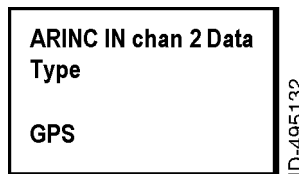
ARINC IN chan 2 Data
Type

GPS

ID-495132

**Figure 3059. (Sheet 1 of 1) ARINC IN Channel X Data Type Display**

(13) ARINC IN Channel X Interface Speed

NOTE: X = Channel number.

(a) The following options are offered for selecting the ARINC interface speed for each channel data type:

- Low

- High.

(b) The display screen is as shown in Figure 3060 with one of the options from above.

(c)  Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct ARINC input interface speed. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

```
ARINC IN chan 1
Interface Speed

High
```
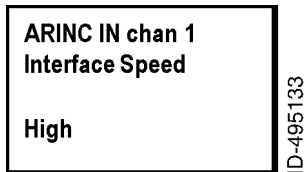ID-495133

**Figure 3060. (Sheet 1 of 1) ARINC IN Channel X Interface Speed Display**

(14)  ARINC OUT Chan 1 Data Type

(a)  The KGX can transmit data through an ARINC 429 output channel. The following options are offered for selecting ARINC 429 output type:

• Not used

• GPS

• Traffic.

NOTE:  Refer to Paragraph 3.C. Step (5) in the CONFIGURATION, CALIBRATION, AND CHECKOUT section for information on selecting ARINC output settings.

(b)  The display screen is as shown in Figure 3061 with one of the options from above.

(c)  Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct ARINC output type. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

NOTE:  If "not used" is selected then the ARINC output line speed configuration mode is not displayed and the next configuration mode item is displayed.

```
ARINC OUT chan 1
Data Type

Traffic
```
ID-495134
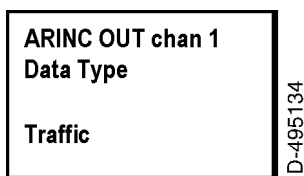
**Figure 3061. (Sheet 1 of 1) ARINC OUT Chan 1 Data Type Display**

(15)  ARINC OUT Chan 1 Interface Speed

(a)  The following options are offered for selecting the ARINC output interface speed:

• Low

• High.

(b)  The display screen is as shown in Figure 3062 with one of the options from above.

(c)  Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct ARINC output interface speed. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

ARINC OUT chan 1
Interface Speed

High

ID-495135

**Figure 3062. (Sheet 1 of 1) ARINC OUT Chan 1 Interface Speed Display**

(16) Select MAX Targets Output

    (a)    This option controls the maximum number of targets which will be sent out the serial or ARINC 429 channels when traffic output has been configured. There are 24 total options offered for selecting MAX targets. These include:

- Integers 8 thru 30

- MAX.

    (b)    The display screen is as shown in Figure 3063 with one of the options from above.

    (c)    Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct number of targets. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

Select Max Targets
Output

10

ID-495136
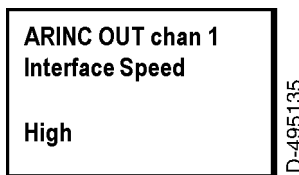
**Figure 3063. (Sheet 1 of 1) Select MAX Targets Output Display**

(17) GPS Certification

    (a)    The KGX requires a valid GPS source so that aircraft position can be transmitted in its ADS-B message. The GPS source is usually certified to a RTCA DO178B software level as mandated by the governing FAA TSO. The following GPS software certification levels can be selected:

- Uncertified

- Level B

- Level C

- Level D.

    (b)    The display screen is as shown in Figure 3064 with one of the options from Step (a).

        NOTE:    For external position sources, contact the manufacturer to obtain the relevant data.

    (c)    Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct GPS certification level. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

```
Select GPS
Certification


Level C
```
ID-495137
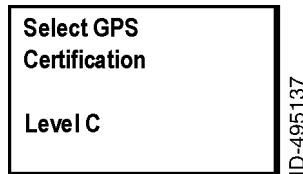
**Figure 3064. (Sheet 1 of 1) GPS Certification Display**

(18) GPS NAC Velocity

    (a) The GPS source used in the installation must have a navigation accuracy category for velocity (NACv) setting specified by the GPS manufacturer. Use the GPS manufacturer's setting to set this. The following options are available for selection:

        1.    Unknown

        2.    10 meters for each second

        3.    3 meters for each second

        4.    GPS Auto.

    (b) The display screen is as shown in Figure 3065 with one of the options from above.

    (c) Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct GPS certification level. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode.

    (d) Unknown, 10 meters/sec, and 3 meters/sec are permanent set at installation in the software. GPS auto is automatically set from the velocity FOM (VFOM) data from the GPS unit. The NACv value is hard-coded to be broadcast better than 3 meters/sec even if GPS Auto is selected.

```
Select GPS
NAC velocity

Unknown
```
ID-495138
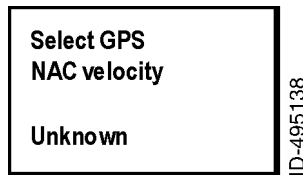
**Figure 3065. (Sheet 1 of 1) GPS NAC Velocity Display**

(19) Aircraft Length

    (a) The aircraft length can be set from 1 meter to 75 meters by rotating the CODE knob either clockwise or counterclockwise to display the correct length. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.

    (b) The display screen is as shown in Figure 3066.

```
Set Aircraft
Length


Meters:      50
```
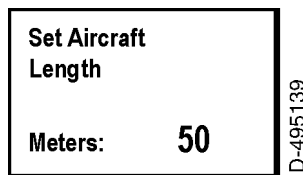ID-495139

**Figure 3066. (Sheet 1 of 1) Aircraft Length Display**

(20) Aircraft Width

    (a) The aircraft width can be set from 1 meter to 80 meters by rotating the CODE knob either clockwise or counterclockwise to display the correct width. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.

(b)    The display screen is as shown in Figure 3067.
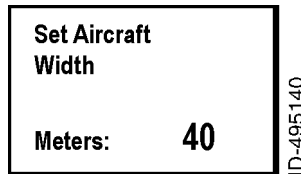
**Set Aircraft
Width**

**Meters:        40**

ID-495140

**Figure 3067. (Sheet 1 of 1) Aircraft Width Display**

(21)  GPS Reference Position Offset

(a)    There are three modes by which the GPS reference offset can be set:

   • Unknown

   • Auto Set by GPS

   • Manual Set Here.

(b)    The display screen is as shown in Figure 3068 with one of the options from above.

(c)    Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct GPS reference offset. Once selected, press the ENT key to confirm your selection. If "Unknown" or "Auto Set by GPS" is selected the next configuration item in the configuration mode will be displayed. If "Manual Set here" is selected then options for manually entering the GPS antenna reference offset are displayed as shown in Figure 3069.

(d)    The antenna distance from the nose can be entered anywhere between 2 meters and 60 meters by rotating the CODE knob either clockwise or counterclockwise to display the correct distance. Once selected, press the ENT key to confirm selection and move to the lateral offset configuration item in the configuration mode.

(e)    The antenna lateral offset has the following options that can be selected:

   • Unknown

   • Left 0 to 2 meters

   • Left 2 to 4 meters

   • Left 4+ meters

   • Central

   • Right 0 to 2 meters

   • Right 2 to 4 meters

   • Right 4+ meters.

(f)    The display screen is as shown in Figure 3070 with one of the options from above.

(g)    Rotate the CODE knob either clockwise or counterclockwise to display the options above and select the correct antenna offset. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.
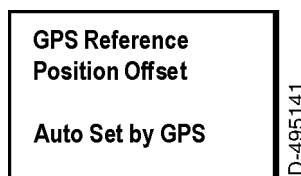
**GPS Reference
Position Offset**

**Auto Set by GPS**

ID-495141

**Figure 3068. (Sheet 1 of 1) GPS Reference Position Offset Display**

**Antenna Distance
From Nose**

**Meters:   25**

ID-495142
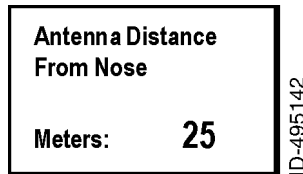
**Figure 3069. (Sheet 1 of 1) Antenna Distance From Nose Display**

**Antenna
Lateral Offset**

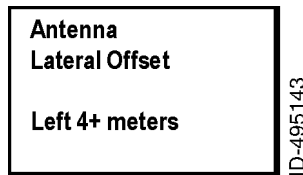**Left 4+ meters**

ID-495143

**Figure 3070. (Sheet 1 of 1) Antenna Lateral Offset Display**

(22)  Mode A/C Receiver Sets Squawk

    (a)  This mode has two options:

        • Enable

        • Disable.

    (b)  Set to "enable" when configuring for use with a transponder that does not have digital control output. This allows the internal or external transponder monitor sniffer antenna to detect the squawk code being broadcast from the airplane and use this same one in the ADS-B Out messages.

    (c)  Set to "disable" when using a transponder with digital control output.

    (d)  The display screen is as shown in Figure 3071 with one of the options from above.

    (e)  Rotate the CODE knob either clockwise or counterclockwise to display the options above and select either enable or disable. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.

**Mode A/C receiver sets
squawk**

**Enable**

ID-495144
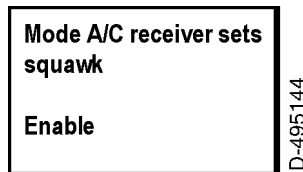
**Figure 3071. (Sheet 1 of 1) Mode A/C Receiver Sets Squawk Display**

(23)  1090 MHz Receiver Installed

    (a)  The display screen is as shown in Figure 3072 with either YES or NO options.

    (b)  Rotate the CODE knob either clockwise or counterclockwise to display either YES or NO and select the correct option. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.

**1090MHz Receiver
Installed**

**No**

ID-495145

**Figure 3072. (Sheet 1 of 1) 1090 MHz Receiver Installed Display**

(24) UAT Receiver Installed

(a) The display screen is as shown in Figure 3073 with either YES or NO options.

(b) Rotate the CODE knob either clockwise or counterclockwise to display either YES or NO and select the correct option. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.

UAT Receiver Installed

YES

ID-495146
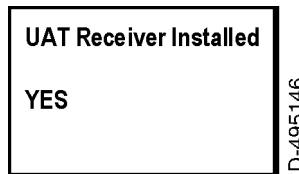
**Figure 3073. (Sheet 1 of 1) UAT Receiver Installed Display**

(25) UAT Antenna Diversity

(a) The KGX supplies the flexibility for installing either one or two approved UAT antennas. A single antenna can either be installed on the top of the aircraft fuselage or on the belly of the aircraft. When two antennas are installed they are installed on the top and bottom of the aircraft. The following options can be selected:

• Top only

• Bottom only

• Dual.

NOTE: The default value is set at "Bottom Only".

(b) The display screen is as shown in Figure 3074.

(c) Rotate the CODE knob either clockwise or counterclockwise to display the correct antenna diversity option. Once selected, press the ENT key to confirm selection and move to the next configuration item in the configuration mode.

NOTE: It is recommended to install dual antennas for maximum coverage.

NOTE: Top only installations are not allowed at this time.

UAT Antenna Diversity

Top Only

ID-495147
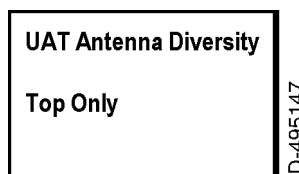
**Figure 3074. (Sheet 1 of 1) UAT Antenna Diversity Display**

(26) Check Ground on UAT Antenna

(a) Confirm if the UAT antenna(s) used have a ground connection that allows the KGX 150T/130T to check if the antenna is installed by selecting the YES or NO options. Rotate the CODE knob either clockwise or counterclockwise to display either YES or NO and select the correct option. The display is as shown in Figure 3075.

(b) Once selected, press the ENT key to confirm selection and complete the configuration setup.
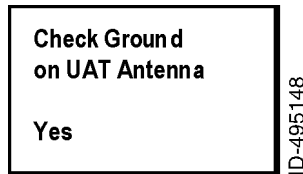
**Figure 3075. (Sheet 1 of 1) Check Ground on UAT Antenna Display**

## 6.  KGX Control Panel Test and Calibration

### A.  Local Voltage Supply Test

(1)  The KGX control panel utilizes a DC supply voltage of 5.5 to 8 volts.  The display typically shows the supply voltage between 6.5 to 7.1 volts as shown in Figure 3076.



**Figure 3076. (Sheet 1 of 1) Local Voltage Supply Test Display**

(2)  There is no option or configuration to be entered or selected in this step. Press the ENT key or the FN key and move to the next configuration item in the configuration mode.

### B.  KGX Control Panel Altitude Encoder Calibration

(1)  General

(a)  The KGX control panel includes a built-in altitude encoder.  The KGX control panel reports pressure altitude on Pin 4 of the DB-9 male connector on the back of the KGX control panel as RS-232 serial data, at 9600 bps, using the format comm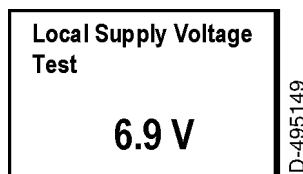only called "Icarus" format. SERIAL INTERFACE SPECIFICATIONS, Paragraph 2, provides further details of interfacing the altitude encoder with the primary static pressure of the aircraft altimeter.

(b)  The calibrate altitude encoder setup allows the recalibration of the altitude encoder. This ensures that the altitude seen on the pilot's primary altimeter is the same as what is transmitted by the KGX. The maximum allowed difference between the primary altimeter and the altitude encoder is 125 feet (38.1 m) in ETSO C88a and TSO C88b.

(c)  The altitude encoder in the KGX control panel is accurately calibrated in the factory to be within 50 feet (15.3 m) of the applied pressure altitude at all altitudes, whereas the allowed error in the primary altimeter increases with altitude, and above 18,000 feet (3.41 mile) the altimeter error alone can exceed 125 feet (38.1 m).

(d)  It is therefore possible that the combination of the allowed errors in the encoder and the primary altimeter can exceed 125 feet (38.1 m), in which case the altitude encoder must be adjusted to correspond to the primary altimeter.

NOTE:  The purpose of calibrating the encoder is to make the output correspond to the primary altimeter. The encoder calibration procedure must therefore only be undertaken after the primary altimeter has been tested and found to comply with the relevant standards.

(2)  Calibration Equipment

(a)  To calibrate the encoder, the KGX control panel must be powered up and you will need a pitot-static test set with the appropriate adapters to connect to the static port on the

aircraft. The pitot-static test set must be able to drive the altitude down to sea level, and above the service ceiling of the aircraft.

(b)     No test set is required. The calibration procedure displays all the information you need on the screen of the KGX control panel.

(3)     Calibration Procedure

(a)     There are two adjustment points on the altitude encoder, a low altitude adjustment point, and a high altitude adjustment point. The low altitude point adjusts the correspondence at sea level, and the high altitude point adjusts the correspondence at the altitude limit of the encoder.  Since the altitude limit of the encoder is likely to be higher than the service ceiling of the aircraft, it is sufficient to set the upper adjustment at the service ceiling of the aircraft.

CAUTION:     DO NOT EXCEED THE ALTITUDE OR RATE OF CLIMB LIMITS OF THE PITOT-STATIC INSTRUMENTS OF THE AIRCRAFT. THE KGX CONTROL PANEL ALTITUDE ENCODER IS A SOLID STATE DEVICE AND WILL NOT BE AFFECTED BY EXCESS ALTITUDE OR RATE OF CLIMB AND DESCENT, BUT THE MECHANICAL INSTRUMENTS IN THE AIRCRAFT CAN EASILY BE DAMAGED BY BEING DRIVEN BEYOND THEIR INTENDED RANGE.

1     Set the primary altimeter subscale setting to 29.92 in-Hg (1013.2 hPa).

2     Connect the pitot-static test set to the aircraft.

3     You can enter the altitude encoder calibration setup either after following the steps from above in order or you can enter directly by holding the FN button down on the KGX control panel on power up to enter setup mode, and skipping over the configuration modes until reaching the calibrate altitude encoder section. When you are in the calibrate altitude encoder setup mode the display shows the information shown in Figure 3077.

4     Rotate the CODE knob either clockwise or counterclockwise to display either YES or NO and select the correct option. Once selected, press the ENT key to confirm your selection and move to the next configuration item in the configuration mode. If NO is selected then the next configuration item in the configuration mode will be displayed.  If YES is selected then options for calibrating the altitude encoder are as shown in Figure 3078.

5     On selecting YES the low altitude set point will now be active, and an altitude will be displayed as shown in Figure 3078.

6     On the static test set, drive the altitude to 0 feet.

7     Read the primary altimeter value; rotate the CODE knob either clockwise or counterclockwise until the altitude displayed on the KGX control panel matches the aircraft primary altimeter.

8     Press ENT and the display will move to the mid altitude set point and an altitude will be displayed as shown in Figure 3079. On the static test set, drive the altitude to the middle range ceiling of the aircraft.

9     Read the primary altimeter value; rotate the CODE knob either clockwise or counterclockwise until the altitude displayed on the KGX control panel matches the aircraft primary altimeter. Press ENT and the display will move to the high altitude set point and an altitude will be displayed as shown in Figure 3080. On the static test set, drive the altitude to the service ceiling of the aircraft.

10     Read the primary altimeter value. Rotate the CODE knob either clockwise or counterclockwise until the altitude displayed on the KGX control panel matches the aircraft primary altimeter. Press ENT and the display will move to the test altitude screen which is the next configuration item in the configuration mode.

(b)     To complete the testing you must leave the KGX control panel displaying the encoder altitude, and exercise the altitude on the static test set across the altitude range of the aircraft. The display will be as shown in Figure 3081 for pressure altitude reported.

(c)     Use at least 10 test points, and verify that in each case the altitude displayed on the primary altimeter and the altitude displayed on the KGX control panel correspond within the 125-foot tolerance. Lightly tap the altimeter at each test point to eliminate friction effects.

**Calibrate Alt Encoder**

**Yes**

ID-495150
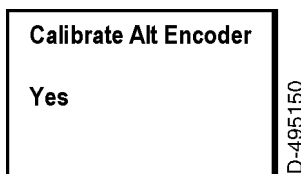
**Figure 3077. (Sheet 1 of 1) Calibrate Alt Encoder Display**

**Alt Encoder Cal**
**Low Altitude 0ft**

**100**

ID-495151
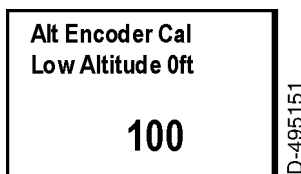
**Figure 3078. (Sheet 1 of 1) Alt Encoder Cal Low Altitude 0ft Display**

**Alt Encoder Cal**
**Mid Altitude FL100**

**308**

ID-495152
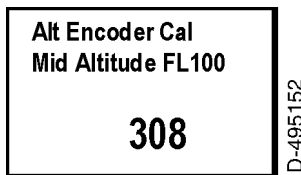
**Figure 3079. (Sheet 1 of 1) Alt Encoder Cal Mid Altitude FL100 Display**

**Alt Encoder Cal**
**High Altitude FL300**

**608**

ID-495153
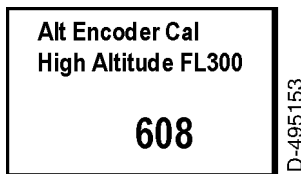
**Figure 3080. (Sheet 1 of 1) Alt Encoder Cal High Altitude FL300 Display**

**Pressure Altitude**
**Reported**

**608**

ID-495154
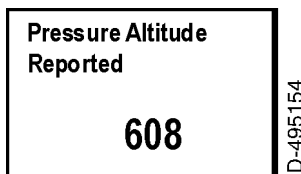
**Figure 3081. (Sheet 1 of 1) Pressure Altitude Reported Display**

(4) Pressure Altitude Reported

    (a) Pressure altitude is displayed after the altitude calibration setup has been completed. The display shows the reported pressure altitude and must match the altitude reported by the primary altimeter. Refer to Figure 3082.
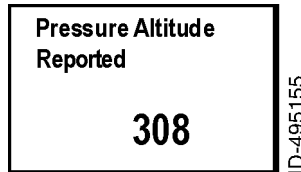


**Figure 3082. (Sheet 1 of 1) Pressure Altitude Reported Display**

    (b) Push the ENT button and the display instructs completion of setup and powers off the system. Refer to Figure 3083.
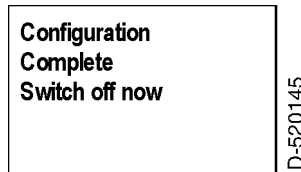


**Figure 3083. (Sheet 1 of 1) Configuration Complete Switch Off Now Display**

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## TROUBLESHOOTING

### 1. General

#### A. Overview

(1) This section provides information for troubleshooting problems that occur after KGX installation. This section contains information on how to use the KGX LEDs and KGX control panel (if installed) to troubleshoot installation problems. Refer to the CONFIGURATION, CALIBRATION, AND CHECKOUT section to setup and configure the system.

### 2. KGX LED Troubleshooting Procedure

#### A. General

(1) Table 4001 is a quick reference troubleshooting guide using the KGX LEDs.

**Table 4001. Troubleshooting Guide**

| Problem | Potential Cause | Troubleshooting |
|---------|-----------------|-----------------|
| No LED activity | No power | Verify power is turned on. Check power connections to unit. |
| TX LED not active | Unit is not transmitting ADS-B messages | Check antenna connections. Check KGX control panel system messages. |
| RX LED not active | Unit is not receiving ADS-B messages | Check antenna connections. Check KGX control panel system messages. |
| ST LED is on | A fault with the unit | Check KGX control panel system messages. |
| ST LED is flashing quickly | GPS fault has occurred | Check GPS connection/configuration. Check KGX control panel system messages. |
| GPS LED is flashing slowly | GPS is acquiring satellites | Allow 2 to 3 minutes for GPS tracking. Check GPS antenna. Check GPS for problems. |
| GPS LED is off | GPS not communicating | Check GPS connection. Check installation configuration. |
| GPS LED is flashing quickly | GPS is reporting a fault | Check GPS for fault. |

#### B. UAT Status LED/Discrete Fault Indications

(1) The status LED/discrete is an indicator of a fault reported by the KGX. The status LED is visible on the KGX or the discrete can be connected to a cockpit annunciator. Potential faults that cause the UAT status LED to turn on and the status discrete to be active (ground) are listed in Table 4002.

**Table 4002. UAT Status LED/Discrete Fault Indications**

| Problem Reported | Reported By |
|------------------|-------------|
| RF transmission failure | PBIT |
| Bottom antenna not connected (if DC ground check configured) | PBIT |
| Top antenna not connected (if DC ground check configured) | PBIT |

**Table 4002.  UAT Status LED/Discrete Fault Indications (Cont)**

| Problem Reported | Reported By |
|---|---|
| RF transmission power too low | PBIT |
| GWSS not communicating or reporting fault | PBIT |
| RF transmit power supply low | PBIT |
| Internal temperature too high | PBIT |
| RF transmit reverse power too high | PBIT |
| Nominal message rate not once for each second | PBIT |
| Broadcast monitor failure - All message types not transmitted | PBIT |
| Nominal message rate not once for each second | PBIT |
| Internal power supply failure | PBIT |
| UART serial channel loopback test failure | POST |
| ARINC 429 channel loopback test failure (KGX) | POST |
| General processing/interface hardware failure | POST |
| Transceiver hardware check failure | POST |

## 3.   System Messages

### A.   General

(1)   If the KGX detects a malfunction, the KGX control panel displays the MSG icon in the center of the LCD. Depending on the nature of the malfunction, the KGX can possibly not be transmitting ADS-B messages. To view the system messages on the Warning page, push the FN button four times and WARNING is displayed top center along with a brief description of the fault. The Warning page is only available when the MSG icon is present.

(2)   When the Warning page is displayed, the KGX control panel continually requests the active system messages. The MSG icon will remain as shown as long as system messages are still present.

(3)   The MSG icon is only present when a malfunction is present.  A log of system messages can be accessed using the MPI.

(4)   Refer to Table 4003 for the KGX control panel system messages.

**Table 4003.  KGX Control Panel System Messages**

| System Message | Description |
|---|---|
| Synth Unlock | Transceiver diagnostic - Timing fault |
| Tx Fault | UAT transceiver fault |
| Tx Power Low | UAT transceiver power low during transmit |
| Tx PSU High | UAT transceiver power supply output too high |
| Tx PSU Low | UAT transceiver power supply output too low |
| Squitter Fail | System diagnostic |

**Table 4003. KGX Control Panel System Messages (Cont)**

| System Message | Description |
|---|---|
| Remote Hot | KGX internal temperature too high |
| No ADS-B Pos | The unit is not receiving digital serial communication from the GPS |
| GPS Fault | GPS has reported unavailable position or a fault |
| Top ant Fault | Top antenna disconnected (if DC ground check configured) |
| Bot ant Fault | Bottom antenna disconnected (if DC ground check configured) |
| PSU Fail | Internal DC power supply failure |
| ADC Fault | ADC or altitude sensor fault or not responding |

B. **KGX Control Panel System Message Troubleshooting**

    (1)    Table 4004 is a quick reference troubleshooting guide using the system messages.

**Table 4004. KGX Control Panel System Message Troubleshooting Guide**

| System | Potential Cause | Troubleshooting |
|---|---|---|
| Synth Unlock | Transmitter can't lock to carrier frequency | Cycle power on the KGX. Return for maintenance if problem persists. |
| Tx Fault | Generic transmitter fault - POST, transmit, address, broadcast, or nominal rate failure | Cycle power on the KGX. Check for valid ICAO address config. |
| Tx Power Low | Transmitter power too low | Check antennas and cabling. Return for maintenance if problem persists. |
| Tx PSU High | Transmitter power supply voltage too high | Cycle power on the KGX. Return for maintenance if problem persists. |
| Tx PSU Low | Transmitter power supply voltage too low | Cycle power on the KGX. Return for maintenance if problem persists. |
| Squitter Fail | Transmitter modulation fault | Cycle power on the KGX. Return for maintenance if problem persists. |
| Remote Hot | KGX internal temperature too high | Cycle power on the KGX. Turn power off for several minutes then back on. Return for maintenance if problem persists. |
| No ADS-B Pos | The unit is not receiving digital serial communication from the GPS. | Verify GPS is functioning. Verify GPS port configuration and speed. Verify GPS communication connection. |
| GPS Fault | GPS has reported no available position or a fault. | Verify GPS is functioning. Verify GPS Antenna Cable connection. Verify GPS Antenna installation/operation. |

**Table 4004. KGX Control Panel System Message Troubleshooting Guide (Cont)**

| System | Potential Cause | Troubleshooting |
|---|---|---|
| Top ant Fault | Top antenna disconnected | Check UAT antenna connection. Make sure antenna is DC grounded. Disable DC ground check in config if antennas are not DC grounded. |
| Bottom ant Fault | Bottom antenna disconnected | Check antenna connection. Make sure antenna is DC grounded. Disable DC ground check in config if antennas are not DC grounded. |
| PSU Fail | Internal DC power supply failure | Cycle power on the KGX. Return for maintenance if problem persists. |
| ADC Fault | Air data computer or altitude encoder fault or not responding | Verify ADC is functioning. Verify ADC port configuration and speed. Verify ADC cable connection. |

# RTCA DO-160 ENVIRONMENTAL QUALIFICATION

## 1. KGX UAT DO-160 Qualification

### A. General

(1) Refer to Table 5001 for the KGX UAT DO-160 qualification.

**Table 5001. KGX UAT DO-160G Qualification**

| Condition | Paragraph | Category | Spec. |
|---|---|---|---|
| Temperature and altitude | 4 | C4/D/A | $-40$ to $+158°$F ($-40$ to $+70°$C) |
| Operating low temperature | 4.5.2 | C4 | $-40°$F ($-40°$C) |
| Operating high temperature | 4.5.4 | C4 | $+158°$F ($+70°$C) |
| Short-time operating low temperature | 4.5.1 | C4 | $-40°$F ($-40°$C) |
| Short-time operating high temperature | 4.5.3 | C4 | $+158°$F ($+70°$C) |
| Ground survival low temperature | 4.5.1 | C4 | $-67°$F ($-55°$C) |
| Ground survival high temperature | 4.5.3 | C4 | $+185°$F ($+85°$C) |
| Loss of cooling | 4.5.5 | NA | - |
| Altitude | 4.6 | D | +50,000 feet (+15,240 m) |
| Decompression | 4.6.2 | A | +50,000 feet (+15,240 m) |
| Overpressure | 4.6.3 | A | $-15,000$ feet (-4,572 m) |
| Temperature variation | 5 | B | - |
| Humidity | 6 | A | - |
| Shock/crash safety | 7 | B | - |
| Vibration | 8 | S (Zone 1, Curve C) and U2 | - |
| Explosive atmosphere | 9 | NA | - |
| Waterproofness | 10 | NA | - |
| Fluids susceptibility | 11 | NA | - |
| Sand and dust | 12 | NA | - |
| Fungus resistance | 13 | NA | - |
| Salt fog | 14 | S | - |
| Magnetic effect | 15 | Z | - |
| Power input | 16 | BB | - |
| Voltage spike | 17 | A | - |

**Table 5001.  KGX UAT DO-160G Qualification (Cont)**

| Condition | Paragraph | Category | Spec. |
|---|---|---|---|
| Audio frequency conducted susceptibility - Power inputs | 18 | Z | - |
| Induced signal susceptibility | 19 | AC | - |
| Radio frequency susceptibility | 20 | TT | - |
| Emission of radio frequency energy | 21 | B | - |
| Lightning, induced transient susceptibility | 22 | A2J3L3 (shielded) A2H3L3 (unshielded) | - |
| Lightning direct effects | 23 | NA | - |
| Icing | 24 | NA | - |
| Electrostatic discharge | 25 | A | - |
| Fire, flammability | 26 | C | - |

## 2.   KGX Control Panel DO-160 Qualification

### A.   General

(1)   Refer to Table 5002 for the KGX Control Panel DO-160 qualification.

**Table 5002.  KGX Control Panel DO-160F Qualification**

| Condition | Paragraph | Category | Spec. |
|---|---|---|---|
| Temperature and altitude | 4 | C4/C4/A4 | - |
| Ground survival low temperature | 4.5.1 | C4 | $-67°$F $(-55°$C$)$ |
| Short-time operating low temperature | 4.5.1 | C4 | $-13°$F $(-25°$C$)$ |
| Operating low temperature | 4.5.2 | C4 | $-4°$F $(-20°$C$)$ |
| Short-time operating high temperature | 4.5.3 | C4 | $+158°$F $(+70°$C$)$ |
| Ground survival high temperature | 4.5.3 | C4 | $+185°$F $(+85°$C$)$ |
| Operating high temperature | 4.5.4 | C4 | $+131°$F $(+55°$C$)$ |
| Loss of cooling | 4.5.5 | NA | - |
| Altitude | 4.6 | D | +35,000 feet (+10,668 m) |
| Decompression | 4.6.2 | A | +50,000 feet (+15,240 m) |
| Overpressure | 4.6.3 | A | $-15,000$ feet $(-4,572$ m$)$ |
| Temperature variation | 5 | A | - |
| Humidity | 6 | A | - |

**Table 5002. KGX Control Panel DO-160F Qualification (Cont)**

| Condition | Paragraph | Category | Spec. |
|---|---|---|---|
| Shock/crash safety | 7 | B | - |
| Vibration | 8 | U (Curve G) | - |
| Explosive atmosphere | 9 | NA | - |
| Waterproofness | 10 | W (front face only) | - |
| Fluids susceptibility | 11 | NA | - |
| Sand and dust | 12 | NA | - |
| Fungus resistance | 13 | NA | - |
| Salt fog | 14 | NA | - |
| Magnetic effect | 15 | Z | - |
| Power input | 16 | NA | - |
| Voltage spike | 17 | NA | - |
| Audio frequency conducted susceptibility - Power inputs | 18 | NA | - |
| Induced signal susceptibility | 19 | BC | - |
| Radio frequency susceptibility | 20 | TT | - |
| Emission of radio frequency energy | 21 | M | - |
| Lightning, induced transient susceptibility | 22 | XXJ3L3 (shielded) XXH3L3 (unshielded) | - |
| Lightning direct effects | 23 | NA | - |
| Icing | 24 | NA | - |
| Electrostatic discharge | 25 | NA | - |
| Fire, flammability | 26 | C | - |

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## SERIAL INTERFACE SPECIFICATIONS

### 1. General

#### A. Overview

(1) Two data formats can be selected to accept input from external altitude sensors:

- Encoder altitude - Gray-code to serial altitude converters, etc.
- Air data computer - To select a data format, refer to Paragraph 3.

### 2. Altitude Encoder Format

#### A. General

(1) The altitude encoder data format accepts messages with the following parameters:

- Baud: 9600
- Parity: None
- Start bit: 1
- Data bits: 8
- Stop bit: 1
- Update rate: 1 message for each second.

(2) Compatible devices include Rosetta encoders and serializers (ARS 50 and ARS 100). The compatible format for altitude information is the 10-byte ASCII message shown in Table 6001.

**Table 6001. ASCII Message**

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Contents | A | L | T | | 1 | 2 | 3 | 4 | 5 | c/r |

(3) Some examples include:

- ALT 00000: 0 feet
- ALT −1200: −1200 feet
- ALT 62505: 62,505 feet
- ALT 05604: 5,604 feet.

### 3. Air Data Computer/Sensor Format

#### A. General

(1) The ADC format accepts messages with the following parameters:

- Baud: 9600 (default minimum)
- Parity: None
- Start bit: 1
- Data bits: 8
- Stop bit: 1
- Update rate: 1 message for each second.

(2) Air data messages are accepted when the serial port is set to ENCODER. A packet consists of a set of ASCII message strings. The first character of each packet is an ASCII start-of-text (STX = 02H). The last character of each packet will be an ASCII end-of-text (ETX = 03H).

(3) Each message string begins with one ASCII character to identify it as an air data message (Z). The second character identifies which message it is. The rest of the string consists of one or more alphanumeric ASCII fields. Each message field ends with a carriage return, line feed (CR = 0D0AH).

(4) All numeric fields are ASCII decimal, right justified and zero filled. If the ADC cannot supply data in a particular field, the field is filled with dashes ("-" = 2DH). Table 6002 lists the message items used by the KGX. Additional items can be in the message but they are not used by the KGX.

**Table 6002. KGX Message Items**

| Item Format | Contents | Description |
|---|---|---|
| ZBddd | True air speed | ddd = knots (40 to 600) |
| ZDsdddd | Pressure altitude | s = sign<br>dddd = tens of feet (−100 to +5999) |
| ZKsddd | Vertical speed | s = sign<br>ddd = tens of feet for each minute (−600 to +600) |
| ZRddd | Packet checksum | ddd = number (0 to 255) |

## ADS-B COMPLIANCE

1. **General**

    A. **ADS-B Parameters Supported**

    (1) Table 7001 lists the supported ADS-B parameters.

**Table 7001. Supported ADS-B Parameters**

| No. | Input Data Element | Comments (Use Within KGX) |
|-----|--------------------|----------------------------|
| 1 | ICAO 24-bit address | Installation configuration |
| 2 | Address selection (ICAO vs temporary) | Anonymous discrete input |
| 3 | Latitude | From GPS data |
| 4 | Longitude | From GPS data |
| 5 | Altitude type selection (barometric vs geometric) | Baro unless invalid or inhibited |
| 6 | Barometric pressure altitude | From altitude/air data sensor |
| 7 | Geometric altitude | From GPS data |
| 8 | NIC | From GPS data |
| 9 | Automatic airborne/on-ground indication | Air/ground discrete input |
| 10 | North velocity | From GPS data |
| 11 | East velocity | From GPS data |
| 12 | Ground speed | From GPS data |
| 13 | Track angle | From GPS data |
| 14 | Heading | From configured heading input |
| 15 | Barometric vertical rate | From altitude/air data sensor |
| 16 | Geometric vertical rate | From GPS data |
| 17 | A/V length and width, and POA | Installation configuration |
| 18 | UTC 1 PPS timing | From GPS Data |
| 19 | Emitter category | Installation configuration |
| 20 | Call sign | From controller interface |
| 21 | Emergency/priority status selection | From controller interface |
| 22 | SIL | GPS with HIL or HPL only |
| 23 | System design assurance (SDA) | Installation configuration |
| 24 | SIL supplement | GPS with HIL or HPL only |
| 25 | NACp | From GPS data |
| 26 | NACv | From GPS data |

**Table 7001.  Supported ADS-B Parameters (Cont)**

| No. | Input Data Element | Comments (Use Within KGX) |
|---|---|---|
| 27 | NIC$_{BARO}$ | Non-Gilham altitude sensors only |
| 28 | Capability codes | Installation configuration |
| 29 | TCAS installed and operational | Installation configuration |
| 30 | TCAS/ACAS resolution advisory flag | TCAS RA serial data input |
| 31 | IDENT switch active | From controller interface |
| 32 | Call sign identification | From controller interface |
| 33 | Geometric vertical accuracy (GVA) | From GPS data |
| 34 | Single antenna flag | Installation configuration |
| 35 | NIC supplement flag | From GPS data |
| 36 | Selected altitude type | Not supported in current software |
| 37 | Selected altitude setting | Not supported in current software |
| 38 | Barometric pressure setting | Not supported in current software |
| 39 | Selected heading | Not supported in current software |
| 40 | Status of MCP/FCU mode | Not supported in current software |
| 41 | Mode indicators: Autopilot engaged | Not supported in current software |
| 42 | Mode indicators: VNAV engaged | Not supported in current software |
| 43 | Mode indicators: Altitude hold mode | Not supported in current software |
| 44 | Mode indicators: Approach mode | Not supported in current software |
| 45 | Mode indicators: LNAV engaged | Not supported in current software |
| 46 | Radio height | Not supported in current software |
| 47 | Pressure altitude disable | From controller interface |
| 48 | Airspeed | From altitude/air data sensor |
| 49 | Flight plan ID | From controller interface |

## WIFI MODULE

## 1. General Information

### A. Introduction

(1) This section contains the system installation guidance for the BendixKing WiFi module, PN 89000016-002. The WiFi module provides a robust and affordable solution of transmitting data wirelessly.

### B. System Description

(1) The BendixKing WiFi module is a complete stand-alone embedded wireless LAN access device. The device has on board TCP/IP stack and applications, requiring only four pins (power, 232-TX, 232-RX, GND) to design in for basic usage. The WiFi module is pre-loaded with firmware to simplify integration and minimize applications development time.

### C. WiFi Module Installation Overview

(1) Connectors

    (a) Connectors present on the WiFi module are as follows:

        • Signal / Power (DB-15)

        • Signal / WiFi Antenna (SMA).

        NOTE: The WiFi module SMA antenna is preinstalled with the system.

(2) Status Lights

    (a) Three system status LEDs are present on the front face of the WiFi module. Refer to Figure 8001.

    (b) WiFi Status LEDs

        1 Three status LEDs (AS, T/R, IP) indicate the operational status of the WiFi module interface. Table 8001 describes the LED indicators.

**Table 8001. LED Indicators**

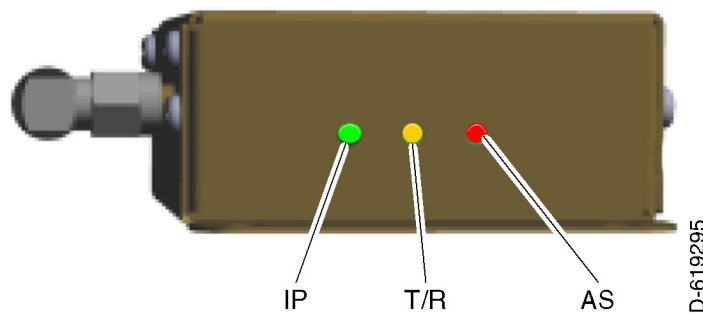| Condition | Red LED (AS) | Yellow LED (Tx/Rx) | Green LED (IP) |
|---|---|---|---|
| On solid | - | - | Connected |
| Fast blink | Not associated | Tx/Rx data transfer | No IP address |
| Slow blink | Associated, no internet | - | IP address OK |
| Off | Associated, internet OK | - | - |



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**Figure 8001. (Sheet 1 of 1) WiFi Module Front Face**

D. **Technical Characteristics**

(1)   Refer to Table 8002 for the WiFi module technical specifications.

**Table 8002.  WiFi Module, PN 89000016-002, Technical Characteristics**

| Characteristic | Specification |
|---|---|
| PMA compliance | Contact BendixKing |
| FCC ID (WiFi unit) | T9J-RN1711 |
| Physical dimensions (with antenna): | |
| • Height | 1.0 inch (25.6 mm) |
| • Width | 3.1 inches (83.8 mm) |
| • Depth | 4.0 inches (101.6 mm) |
| Weight | 2.9 ounces (82.5 gm) |
| Temperature: | |
| • Operating | −40 to +158°F (−40 to +70°C) |
| • Storage | −67 to +185°F (−55 to +85°C) |
| Altitude | 50,000 feet (15.24 km) |
| Power requirements | 10 to 37 VDC, typical 40 mA at 28 VDC |
| Frequency | 2,402 to 2,480 MHz |
| Receiver sensitivity | −83 dBm typical |

(2)   Refer to Table 8003 for the WiFi module interfaces.

**Table 8003.  WiFi Module Interfaces**

| Type | I/O | Description |
|---|---|---|
| Serial [1] | I/O | Serial (RS-232 or RS-422) |
| Display | Output | WiFi |

**NOTE:**
  **1**   Only one port (either 232 or 422) port can be interfaced at one time with the WiFi module.

E. **Parts and Equipment**

(1)   The WiFi module and installation kit part numbers are listed in Table 8004.

**Table 8004. WiFi Module and Installation Kit Part Numbers**

| PN | BendixKing PN | FreeFlight PN |
|---|---|---|
| WiFi Module | 89000016-002 | 86943-00 |
| Installation Kit (Included) | 89000016-017 | 87770-00 |

(2) The items included in the WiFi module installation kit are listed in Table 8005.

**Table 8005. Installation Kit Items, PN 89000016-017**

| Quantity | Description |
|---|---|
| 1 | DB-15 female crimp connector |
| 1 | DB-15 backshell |
| 17 | Crimp pin, AWG 24 to 28 |
| 17 | Crimp pin (barrel type) 24 to 28 AWG |

(3) The items listed in Table 8006 are required, but not supplied by BendixKing.

**Table 8006. Required Accessories**

| Item | Quantity | Description |
|---|---|---|
| Wiring | AR | AWG 24 shielded, twisted pair recommended but not required. Typical interconnect diagram is shown in Figure 8007. |
| Circuit breaker | 1 | 0.5 AMP |

## 2. Installation

### A. General

(1) This section provides general information for installing the WiFi module into an aircraft. This section contains mounting dimensions, pin outs, and interface details pertaining to installation. Adherence to these installation procedures and information will assure satisfactory system performance.

### B. Unpacking and Inspecting Equipment

(1) Exercise care when unpacking each item. Visually inspect each item for evidence of damage incurred during shipment. If a damage claim must be filed, save the shipping container to substantiate the claim. When the equipment and the installation kit have been inspected, save the packing material and container in case the unit is to be stored or reshipped. Refer to Paragraph 1.E. for equipment and parts supplied.

### C. Equipment Mounting

(1) The WiFi module is designed for mounting in any convenient location in the cockpit, the cabin, or an avionics bay.

(2) The following installation procedure must be followed. Remember to allow adequate space for installation of cables and connectors.

(a) Select a position in the aircraft that is not too close to any high external heat source (the WiFi module is not a significant heat source itself).

(b)    Avoid sharp bends and placing the cables near aircraft control cables.

(c)    Attach the WiFi module on a flat surface according to the WiFi module mounting requirements illustrated in Figure 8002.

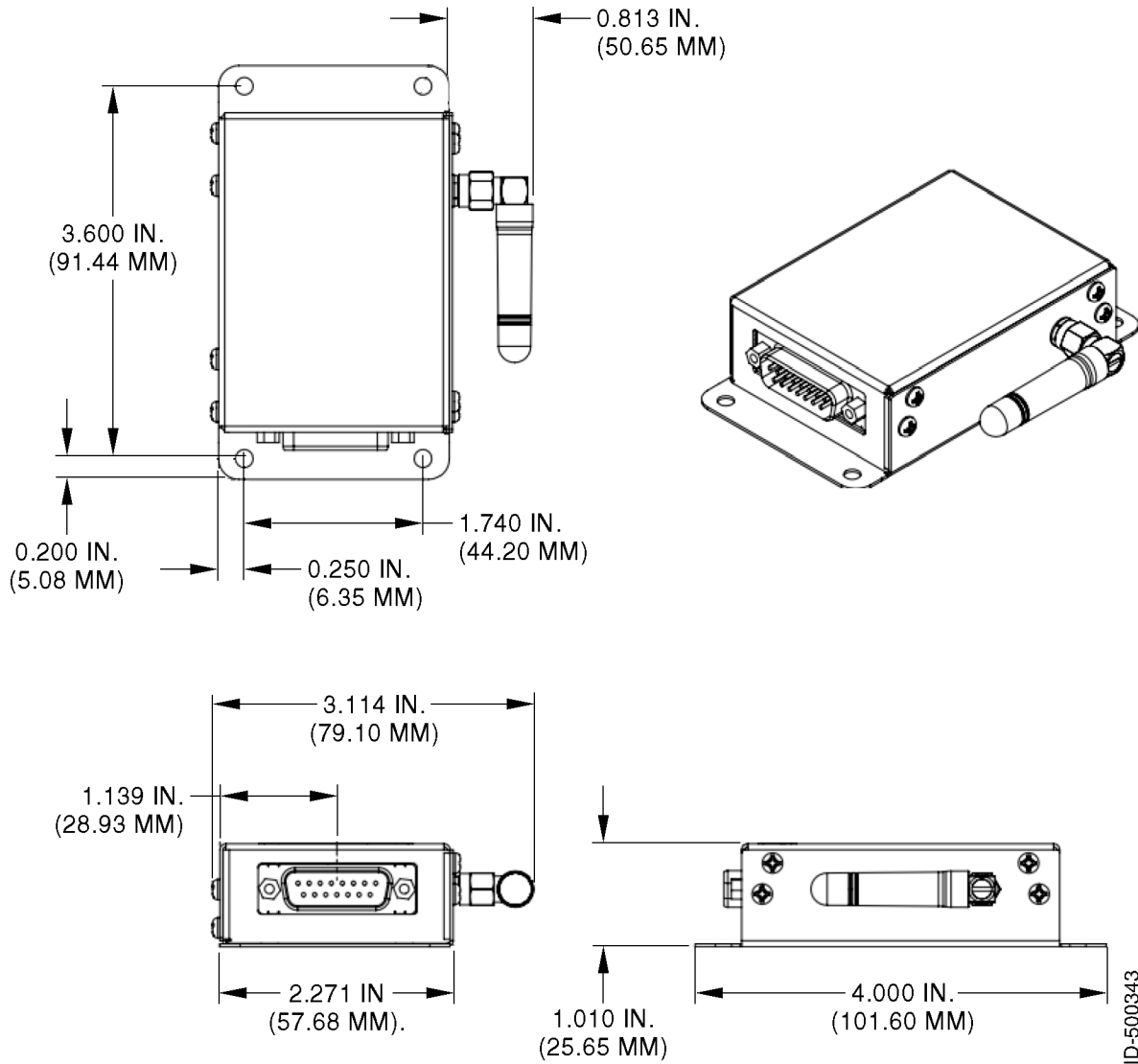

**Figure 8002. (Sheet 1 of 1) WiFi Module Mounting Dimensions**

D.    **Electrical Interface**

(1)    Electrical interconnection to the WiFi module is made through a 15-pin D-sub connector. Refer to Table 8007 for a description of the pin out.

**Table 8007.  Interface Pin Out**

| Pin | Name | Function | I/O | Level |
|---|---|---|---|---|
| 1 | Reset | Optional module reset signal 100k pull up, apply pulse of at least 160 µs, 3.3-volt tolerant. | Input | Active low |
| 2 | 232 TXD1 [1] [2] | Serial Port 1 RS-232 data out | Output | RS-232 |
| 3 | 232 RXD1 [1] [2] | Serial Port 1 RS-232 data in | Input | RS-232 |
| 4 | Reserved | Do not connect | - | - |
| 5 | Ground | Signal ground reference | GND | GND |
| 6 | Reserved | Do not connect | - | - |
| 7 | Power IN | Aircraft voltage in | Power | 10 to 37 VDC |
| 8 | Aircraft ground | Aircraft power return | GND | GND |
| 9 | 422 TXD1+ [1] [2] | Serial Port 1 RS-422 data out+ | Output | RS-422 |
| 10 | 422 TXD1− [1] [2] | Serial Port 1 RS-422 data out− | Output | RS-422 |
| 11 | 422 RXD1+ [1] [2] | Serial Port 1 RS-422 data in+ | Input | RS-422 |
| 12 | 422 RXD1− [1] [2] | Serial Port 1 RS-422 data in− | Input | RS-422 |
| 13 | Reserved | Do not connect | - | - |
| 14 | Reserved | Do not connect | - | - |
| 15 | Reserved | Do not connect | - | - |

**NOTES:**

  **1**   Only one port (either 232 or 422) port can be interfaced at one time with the WiFi module.

  **2**   Default RS-232/422 baud rate is 115,200.

E.   **Connecting to the WiFi Module**

  (1)   The WiFi module can be connected from any device that supports AM 802.11 wireless solution or chipset.  For example, the WiFi module can be connected using a laptop with a wireless chipset or any of the currently available tablets and pads.

  (2)   The instructions are not limited to a Windows laptop or an iPad. They are applicable to other devices as well.  The screen shots provided are examples to aid the user for connecting to the WiFi module.

  (a)   Make sure that the WiFi module is wired and powered on in accordance with Figure 8007.

  (b)   To connect to the WiFi system, make sure that you have a valid wireless connection to the system.

  (c)   If already connected to a WiFi network, disconnect from your current wireless network connection.

  (d)   To connect to the WiFi module wirelessly select the wireless network with the serial number of the WiFi and click connect.  Refer to Figure 8003 thru Figure 8006 for example screen shots.

  (e)   Wait for the WiFi module to acquire a valid network address and state connected.
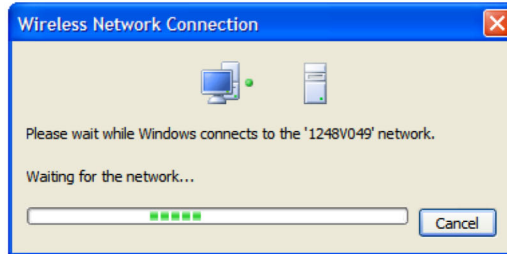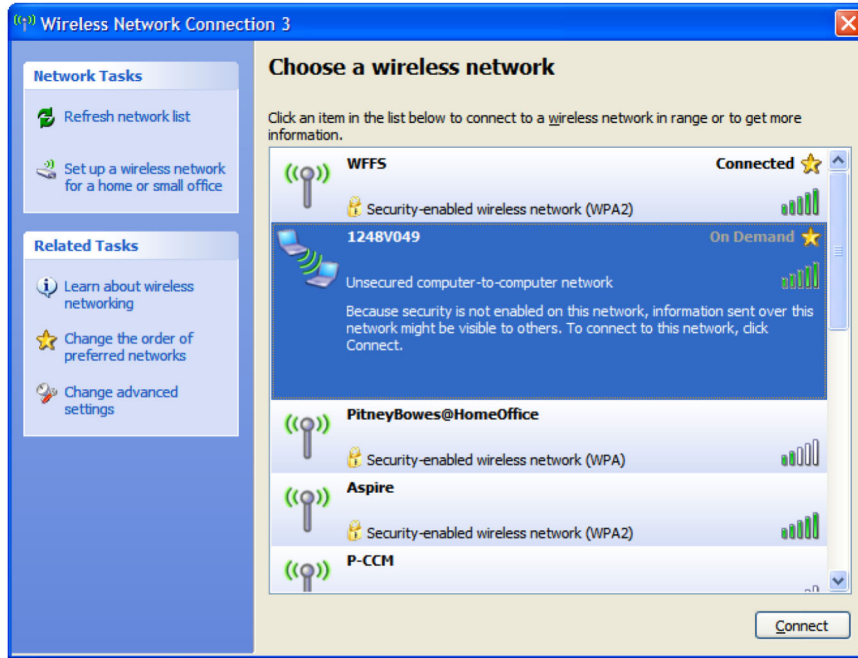
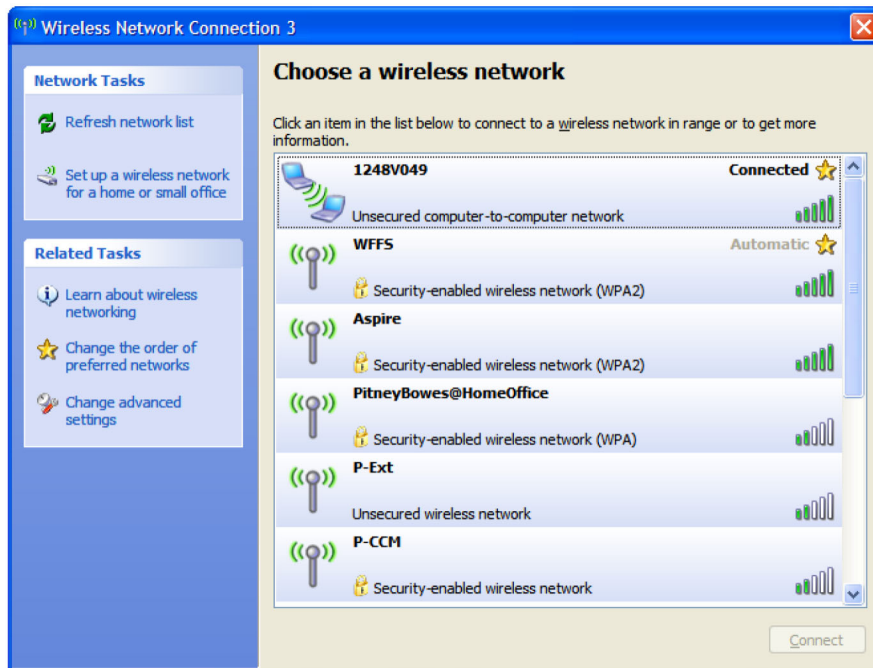**Figure 8003. (Sheet 1 of 1) Example Screen Shots for Connecting to Wireless Network in Windows**
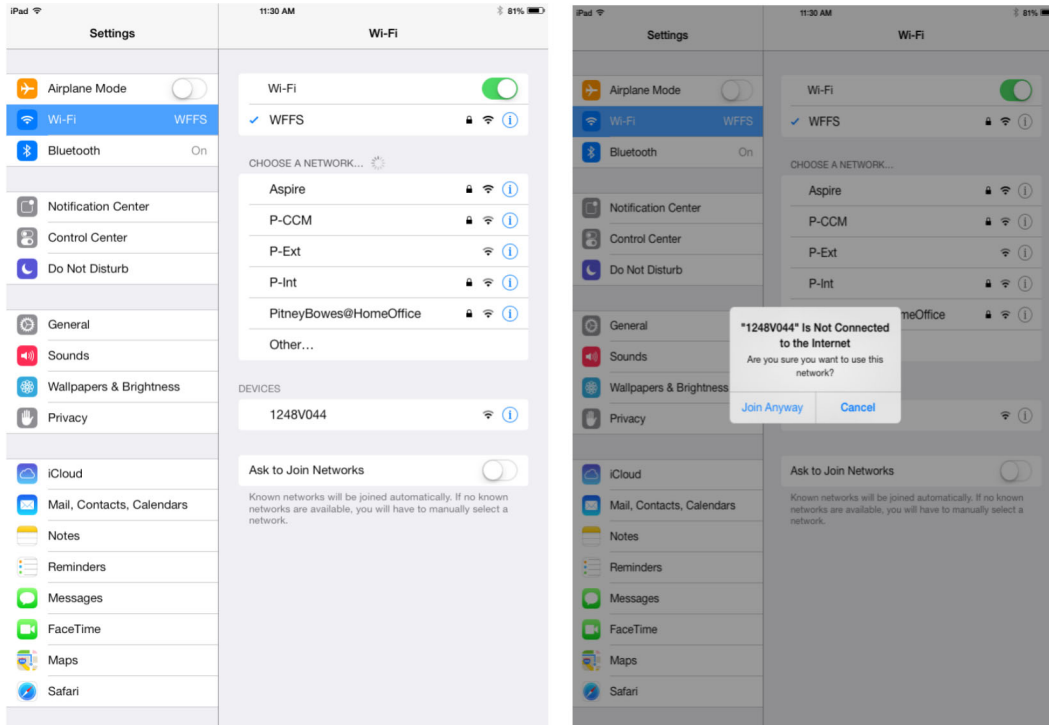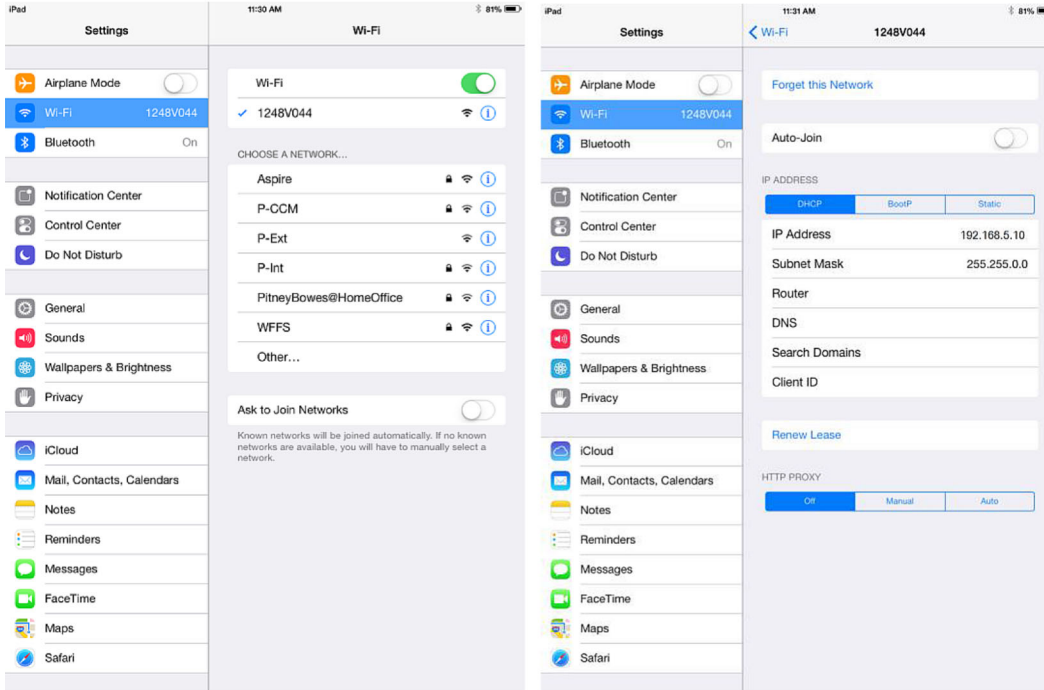
**Figure 8004. (Sheet 1 of 1) Example Screen Shots for Connecting to Wireless Network on an Apple iPad**

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**Figure 8005. (Sheet 1 of 1) Example Screen Shots for Wireless Windows Connection**

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**Figure 8006. (Sheet 1 of 1) Example Screen Shots for Wireless Apple iPad Connection**

## 3.   RTCA DO-160G Environmental Qualification

### A.   WiFi Module

(1)   Refer to Table 8008 for the WiFi module DO-160G environmental qualifications.

**Table 8008.  WiFi Module DO-160G Environmental Qualifications**

| Environmental Test | Section | Category | Compliance Method |
|---|---|---|---|
| Temperature and altitude | 4 | C4/D/A [1] | T |
| Loss of cooling | 4.5.5 | NA | X [2] |
| Temperature variation | 5 | B | T |
| Humidity | 6 | A | T |
| Shock/crash safety | 7 | NA | X |
| Vibration | 8 | S (Zone 1, curve C) U2 | T |
| Explosion atmosphere | 9 | NA | X |
| Waterproofness | 10 | NA | X |
| Fluids susceptibility | 11 | NA | X |
| Sand and dust | 12 | NA | X |
| Fungus | 13 | NA | X |
| Salt fog | 14 | NA | X |

**Table 8008.  WiFi Module DO-160G Environmental Qualifications (Cont)**

| Environmental Test | Section | Category | Compliance Method |
|---|---|---|---|
| Magnetic effect | 15 | NA | X |
| Power input | 16 | B | T |
| Voltage spike | 17 | NA | X |
| Audio frequency conducted susceptibility - Power inputs | 18 | NA | X |
| Induced signal susceptibility | 19 | NA | X |
| Radio frequency susceptibility | 20 | NA | X |
| Emission of radio frequency energy | 21 | MM [3] | T |
| Lightning, induced transient susceptibility | 22 | A3XXXX | T |
| Lightning direct effects | 23 | NA | X [4] |
| Icing | 24 | NA | X [4] |
| Electrostatic discharge | 25 | NA | X |
| Fire, flammability | 26 | NA | X |
| Compliance method key: T = Test X = No testing required/no credit requested NA = Not applicable | | | |

**NOTES:**

**1**  D: Altitude at +50,000 feet (+15.24 km).
A: Overpressure at −15,000 feet (−4.57 km) and decompression at +50,000 feet (+15.24 km).

**2**  EUT does not require cooling for correct operation.

**3**  Exception at 2.4 GHz as the system transmits at that frequency.

**4**  Required for other equipment (the antenna) only, not for the EUT.

## 4.   Typical Interconnect Diagram

### A.   KGX and WiFi Module Interconnect Diagram

(1)   Refer to Figure 8007 for a typical KGX and WiFi module interconnect diagram.

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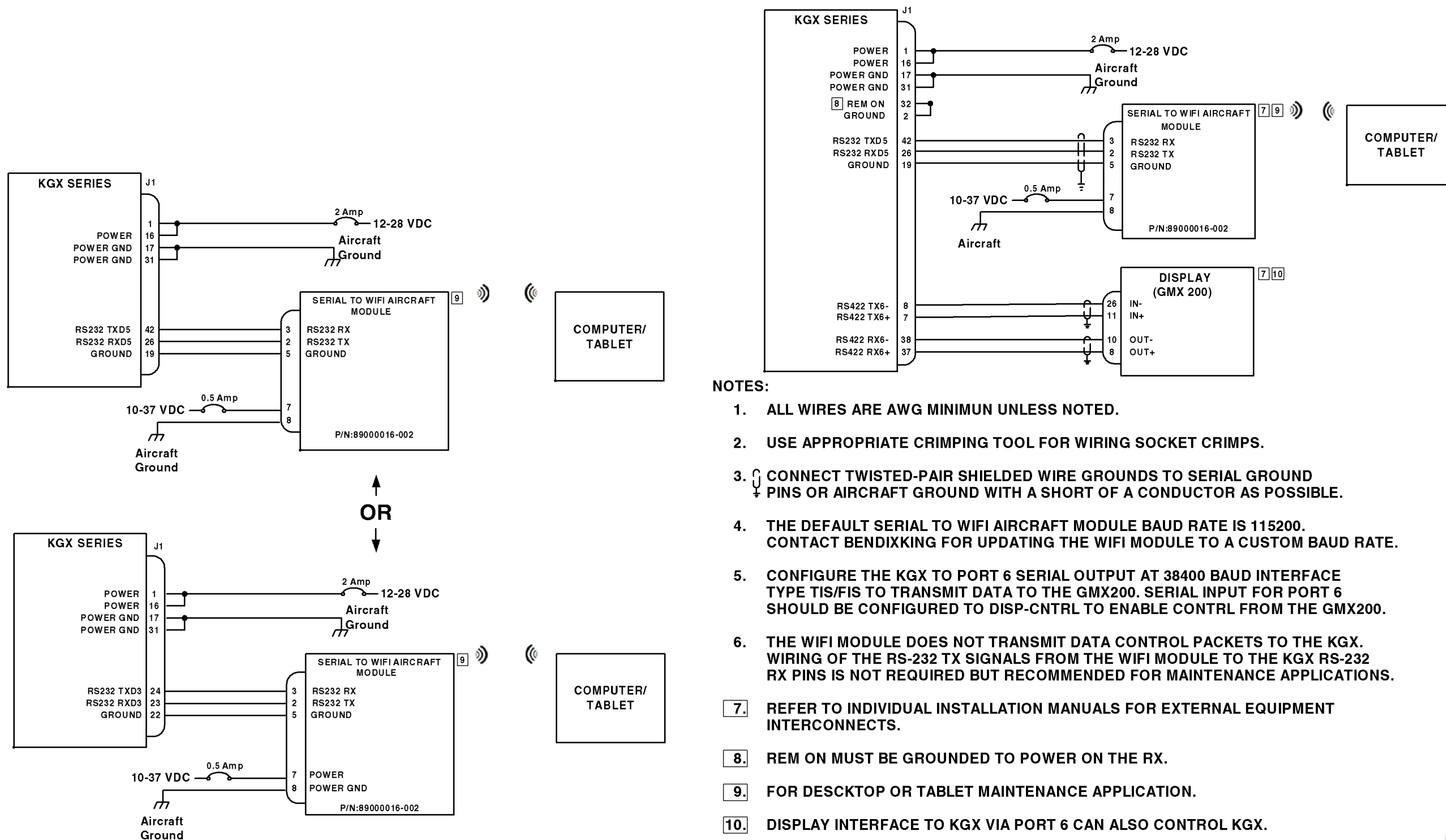**Figure 8007. (Sheet 1 of 1) Typical KGX and WiFi Module Interconnect Diagram**

**NOTES:**

1. ALL WIRES ARE AWG MINIMUN UNLESS NOTED.

2. USE APPROPRIATE CRIMPING TOOL FOR WIRING SOCKET CRIMPS.

3. CONNECT TWISTED-PAIR SHIELDED WIRE GROUNDS TO SERIAL GROUND PINS OR AIRCRAFT GROUND WITH A SHORT OF A CONDUCTOR AS POSSIBLE.

4. THE DEFAULT SERIAL TO WIFI AIRCRAFT MODULE BAUD RATE IS 115200. CONTACT BENDIXKING FOR UPDATING THE WIFI MODULE TO A CUSTOM BAUD RATE.

5. CONFIGURE THE KGX TO PORT 6 SERIAL OUTPUT AT 38400 BAUD INTERFACE TYPE TIS/FIS TO TRANSMIT DATA TO THE GMX200. SERIAL INPUT FOR PORT 6 SHOULD BE CONFIGURED TO DISP-CNTRL TO ENABLE CONTRL FROM THE GMX200.

6. THE WIFI MODULE DOES NOT TRANSMIT DATA CONTROL PACKETS TO THE KGX. WIRING OF THE RS-232 TX SIGNALS FROM THE WIFI MODULE TO THE KGX RS-232 RX PINS IS NOT REQUIRED BUT RECOMMENDED FOR MAINTENANCE APPLICATIONS.

7. REFER TO INDIVIDUAL INSTALLATION MANUALS FOR EXTERNAL EQUIPMENT INTERCONNECTS.

8. REM ON MUST BE GROUNDED TO POWER ON THE RX.

9. FOR DESCKTOP OR TABLET MAINTENANCE APPLICATION.

10. DISPLAY INTERFACE TO KGX VIA PORT 6 CAN ALSO CONTROL KGX.

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